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MANUAL OF INSTRUCTION

FOR THE

ROYAL NAVAL SICK BERTH STAFF.

By

GEORGE O. M. DICKENSON, M.B., B.S., Durham,

Staff Surgeon, R.N.

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PREFACE.

This book has been written for three reasons:—

(1) To provide a Text-Book for the Probationary Sick Berth Attendants.

(2) To promote uniformity of instruction at the Naval Hospitals.

(3) To provide a concise and comprehensive manual for the use of all members of the Sick Berth Staff in preparing themselves for the various examinations for higher ratings.

The compiler's thanks are due to those Medical Officers, Nursing Sisters, and Dispensers who have so willingly assisted him in this work.

He also desires to acknowledge his indebtedness to the St. John Ambulance Association for the description of methods of applying the Triangular Bandage and for the Stretcher Exercises; to the Comptroller of His Majesty's Stationery Office for permission to use certain illustrations from the Royal Army Medical Corps Training (1911); to Fleet Surgeon Gaskell, R.N., for the use of certain illustrations from his book, "First Aid in the Royal Navy"; and to Messrs. Down Bros. for the use of the illustrations of instruments.

The source of these illustrations is indicated under each figure, the remaining drawings being original.

The names and doses of drugs are in accordance with the British Pharmacopœia, 1914.

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INTRODUCTION.

For purposes of description, the body is supposed to be standing upright with the arms hanging down by the sides, and with the palms of the hands to the front.

The following terms are frequently used, and their correct meaning must be remembered :—

Anterior means front, or in front of; thus, the *anterior* surface of the hand is the palm; the trachea is *anterior* to the œsophagus.

Posterior means back, or behind; thus, the *posterior* end of the foot is the heel; the rectum is *posterior* to the bladder.

Internal means inside, or nearer the middle line of the body; thus, the lungs are *internal* organs; the tibia is *internal* to the fibula.

External means outside, or further from the middle line of the body; thus, the skin is the *external* covering of the body; the radius is *external* to the ulna.

Superior means upper, or above; thus, the *superior* end of the humerus is attached to the scapula; the heart is *superior* to the diaphragm.

Inferior means lower, or below; thus, the spinal cord springs from the *inferior* surface of the brain; the liver is *inferior* to the diaphragm.

Many Latin and Greek words are employed in Medicine and Surgery, and the following rules of grammar may help to make the spelling more easily understood :—

Latin words ending in **-us** form their plural by changing the **-us** into **-i** :—

bacillus—bacilli; glomerulus—glomeruli.

Those ending in **-um** change the **-um** into **a** :—

bacterium—bacteria.

Those ending in **-a** change the **-a** into **-æ** :—

vena cava—venæ cavæ.

Greek words ending in **-a** form their plural by changing the **-a** into **-ata** :—

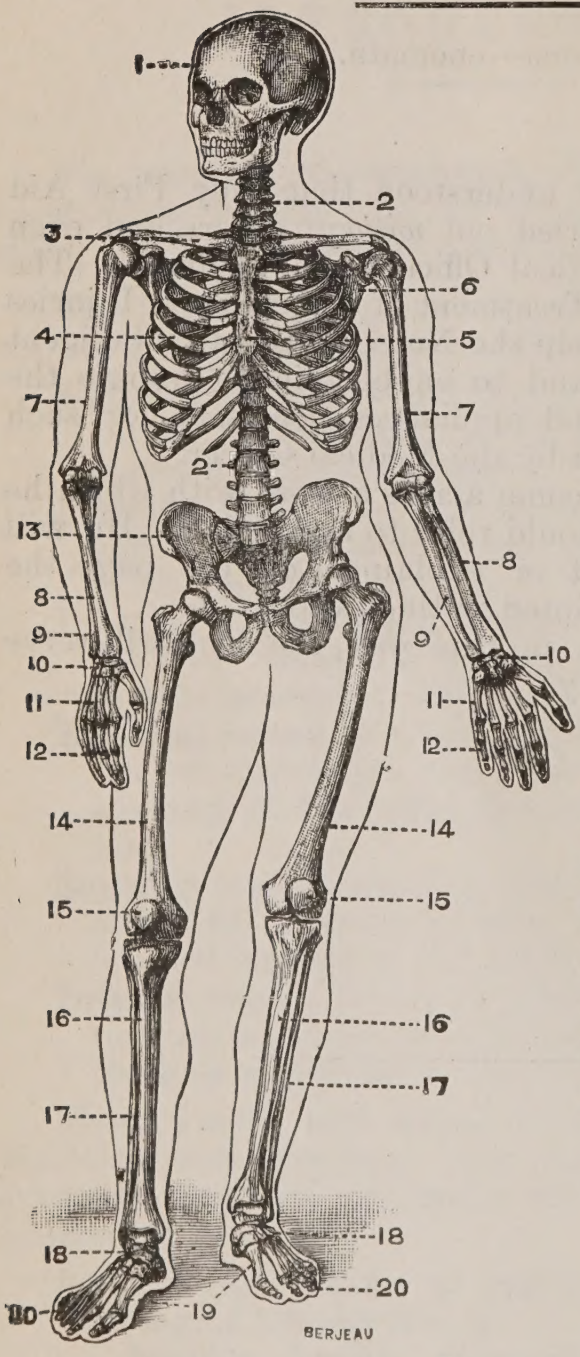
enema—enemata.

It must be clearly understood that only First Aid Treatment may be carried out *without orders*, and even that only when a Medical Officer is not available. The Medical and Surgical Treatment of Diseases and Injuries is given only so as to help the Nurse to take an intelligent interest in his work, and to enable him to prepare the various instruments and appliances necessary for such treatment as is ordered by the Medical Officer.

Should the reader come across a word with which he is unacquainted he should refer to the Index. He will find the word defined or explained on the page the number of which is printed in thick type.

By using the Index in this way, the book will serve as a Medical Dictionary.

FRONTISPIECE.



1. Cranium.
2. Vertebral Column.
3. Clavicle.
4. Ribs.
5. Sternum.
6. Scapula.
7. Humerus.
8. Radius.
9. Ulna.
10. Carpus.
11. Metacarpus.
12. Phalanges.
13. Pelvis.
14. Femur.
15. Patella.
16. Tibia.
17. Fibula.
18. Tarsus.
19. Metatarsus.
20. Phalanges.

Fig. 1.
The Skeleton.
(R.A.M.C. Training.)

Chapter I.

ANATOMY.

Anatomy is the science which deals with the structure of the body.

The human body is composed of

(1) **Tissues,** the chief of which are bone, cartilage, fibrous tissue, muscle, fat, and nervous tissue;

(2) **Fluids,** the chief of which are blood and lymph.

The tissues are composed of innumerable minute bodies called cells, which can only be seen with the aid of a microscope. Each cell consists of a jelly-like substance called *protoplasm*, enclosed in a delicate membrane. It has the power of absorbing nourishment and of multiplying—that is to say, it is alive.! 10

BONE is the hard material which forms the skeleton or framework of the body. It supports the trunk and limbs, protects the internal organs, and gives attachment to the muscles.

It consists of (*a*) **inorganic matter** (chiefly phosphate of lime) and (*b*) **organic matter** (animal cells). The hardness of bone is due to the lime. In children, these substances are present in equal proportions, so that the bones bend, but do not easily break; in adults, there are two parts of lime to one of animal matter, so that the bones are more brittle, and break more easily.

The outside of a bone is dense and hard, like ivory, and is called **compact bony tissue;** the inside consists of a network of fine shreds of bone, which enclose numerous spaces, and is called cancellous or **spongy bony tissue.**

These spaces are filled with marrow and blood vessels. In compact bone are found minute tubes called *Haversian Canals*, through which blood vessels pass.

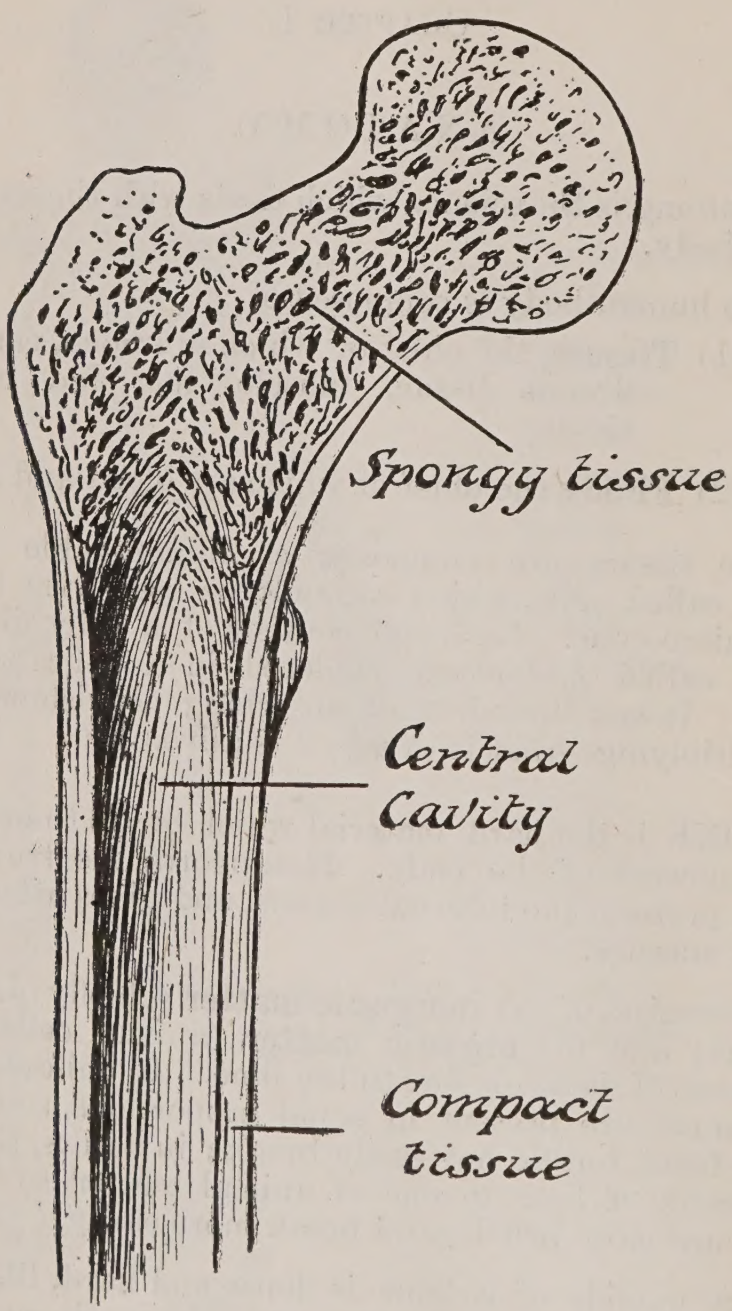


Fig. 2.
Section of a Bone.

All bones are covered with a membrane called *Periosteum*, which is well supplied with blood vessels.

Bones may be divided into four classes :—

Long bones.
Short bones.
Flat bones.
Irregular bones.

The Long Bones consist of a shaft and two extremities, and are found in the limbs, where they form a system of levers. They include the clavicle, humerus, radius, ulna, femur, tibia, fibula, the metacarpal and metatarsal bones and the phalanges.

The Short Bones are found where compactness and strength are required, as in the carpus and tarsus.

The Flat Bones are required for the protection of the internal organs of the body. They are the cranial bones, the sternum, scapulæ, ribs, innominate bones and patellæ.

The Irregular Bones are those which cannot be classed in any of the above groups, and consist of the bones of the face and the vertebræ.

CARTILAGE is a firm, tough, flexible, and elastic substance which is not supplied with blood. All bones are developed from cartilage, but some cartilage remains flexible throughout life. This permanent cartilage is employed in the body :—

(1) To help in forming a flexible framework, as in the costal cartilages.
(2) To act as buffers in deadening shock, as in the intervertebral discs.
(3) To deepen the bony cavities of joints, as in the acetabulum.
(4) To prevent the collapse of tubes intended to remain open, as in the trachea.
(5) To form a smooth covering for the ends of bones, so that they glide easily over one another in a joint.

FIBROUS TISSUE.

Fibrous or connective tissue is employed in almost every part of the body to support and connect other tissues. When present in masses it appears as a collection of white glistening fibres, which are very strong, but only slightly elastic. Its uses are :—

(1) To bind the bones together in the form of **ligaments.**

(2) To connect the muscles to the bones in the form of **tendons.**

(3) To cover and protect various organs and tissues in the form of **membranes.** Examples of this are the sheaths of muscles, bones (periosteum), nerves and blood vessels, and the capsules of the liver and kidneys.

Ligaments are strong fibrous bands which bind the bones together. They are slightly elastic, and allow movement of the bones to a limited extent.

MUSCULAR TISSUE.

Muscular tissue consists of bundles of reddish coloured fibres which have the power of contracting. There are two kinds of muscular tissue, voluntary and involuntary.

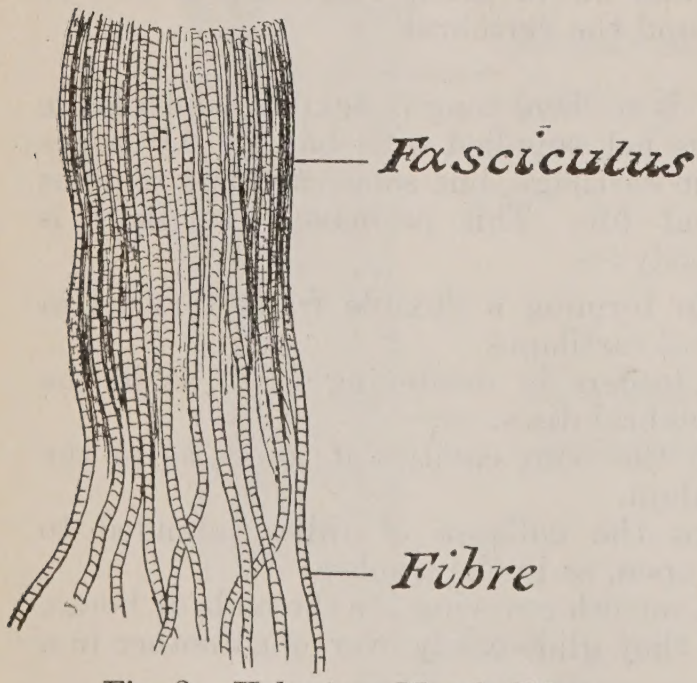


Fig. 3.—Voluntary Muscle Fibre.

1. Voluntary Muscular Tissue is composed of bundles of fibres, each bundle being called a *fasciculus.* Each individual fibre composing a fasciculus is surrounded by a sheath called the *sarcolemma.* These fibres are built up in such a way that, under a microscope, they show alternate dark and

light transverse bands, which give them a striped appearance. This variety is, therefore, sometimes called *striated muscular tissue.*

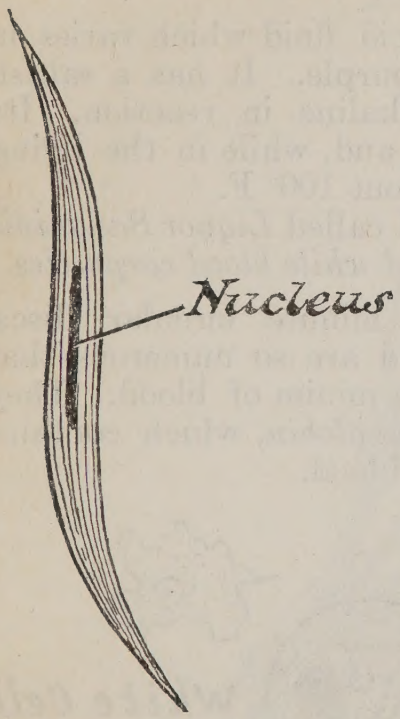


Fig. 4.
Involuntary Muscle Fibre.

2. Involuntary Muscular Tissue is composed of bundles of fibres cemented together, but not surrounded by sarcolemma Each fibre is spindle-shaped, but is not striped. This variety is, therefore, sometimes called *unstriated muscular tissue.*

All muscular tissue is plentifully supplied with blood vessels and nerves.

FAT OR ADIPOSE TISSUE.

This consists of a loose meshwork of connective tissue enclosing fat cells. It is found in every part of the body except the eyelids, the lungs, and the brain, the amount varying considerably in different individuals.

NERVOUS TISSUE.

All the nervous tissue in the body is contained in the cerebro - spinal and sympathetic nervous systems.

Nervous tissue consists of *nerve cells* and *nerve fibres.* The cells, which generate and receive nervous impulses, are found in the brain, medulla, spinal cord and ganglia. The fibres, which only transmit the

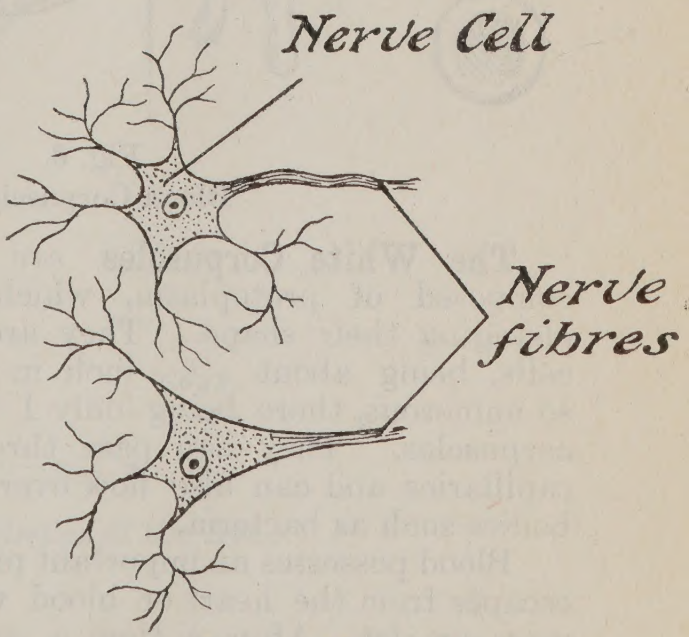


Fig. 5.—Nerve Cells.

impulses, are found in the cranial, spinal and sympathetic nerves.

BLOOD.

Blood is a thick, opaque, viscid fluid which varies in colour from bright scarlet to purple. It has a saltish taste, a faint odour, and is alkaline in reaction. Its specific gravity is about 1,055, and, while in the living body, it has a temperature of about 100° F.

It consists of a colourless fluid called *Liquor Sanguinis* or *Plasma*, in which float *red and white blood corpuscles.*

The Red Corpuscles are minute circular discs, about $\frac{1}{3200}$ inch in diameter, and are so numerous that 300,000,000 are contained in one minim of blood. They contain a substance called *Hæmoglobin*, which contains iron and gives the red colour to blood.

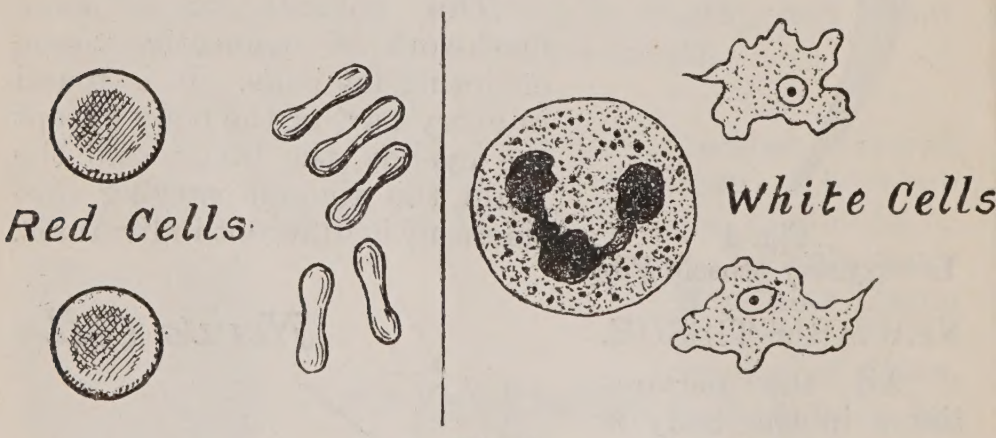


Fig. 6.
Blood Corpuscles.

The White Corpuscles are soft, jelly-like bodies composed of protoplasm, which have the power of changing their shape. They are larger than the red cells, being about $\frac{1}{2500}$ inch in diameter and are not so numerous, there being only 1 white to every 700 red corpuscles. They can pass through the walls of the capillaries and can also flow over and surround smaller bodies such as bacteria.

Blood possesses an important property in that, when it escapes from the heart or blood vessels, it forms a solid mass or *clot.* After a time a pale yellow fluid, called

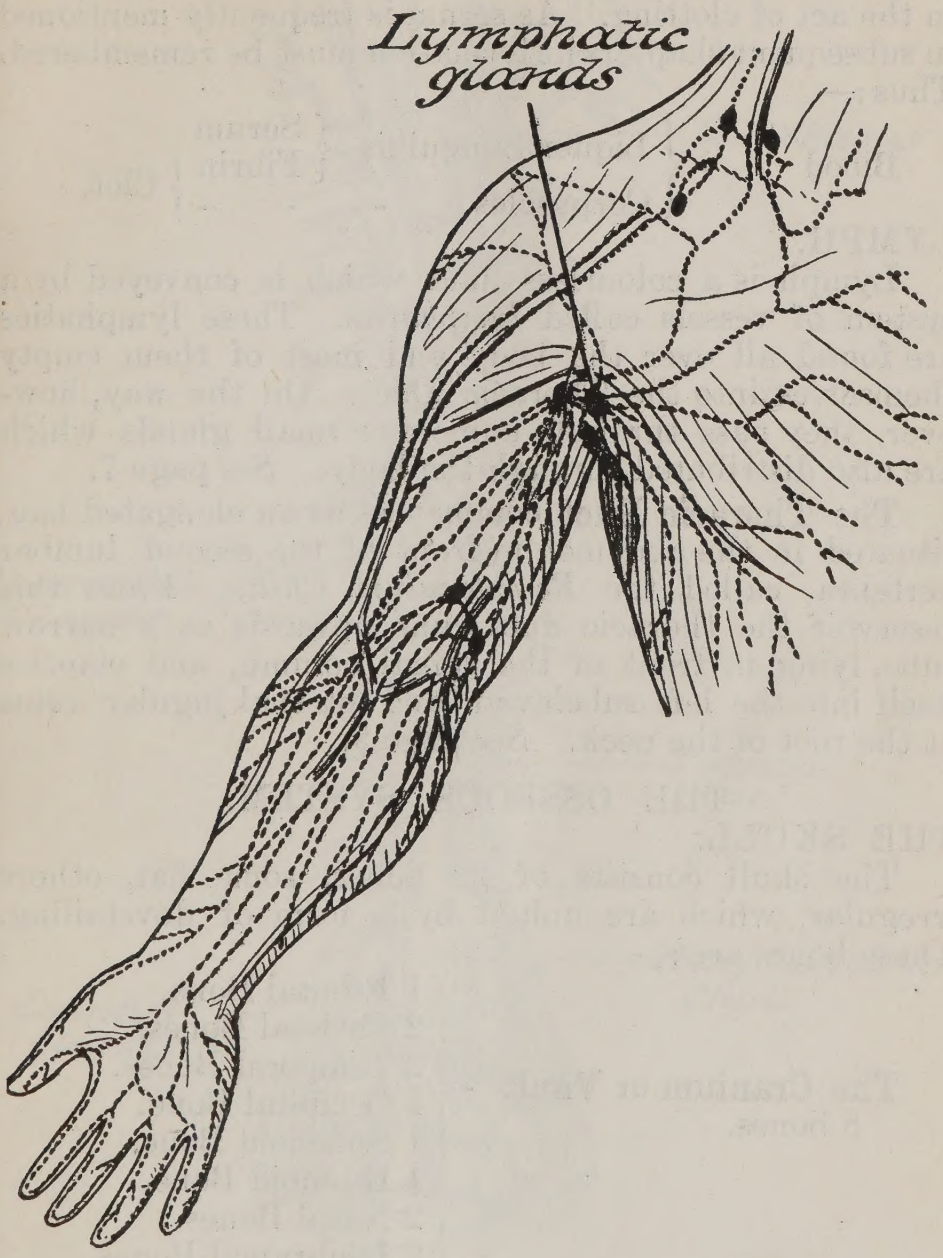


Fig. 7.

Lymphatics of the Arm.

serum, escapes from the clot, which now consists of corpuscles and a substance called *fibrin* which is produced in the act of clotting. As serum is frequently mentioned in subsequent chapters its formation must be remembered. Thus :—

Blood - { Liquor Sanguinis { Serum / Fibrin } / Corpuscles - - - } Clot.

LYMPH.

Lymph is a colourless fluid which is conveyed by a system of vessels called *lymphatics*. These lymphatics are found all over the body and most of them empty themselves into the Thoracic Duct. On the way, however, they pass through numerous small glands which are also distributed through the body. *See* page 7.

The Thoracic Duct commences as an elongated bag, situated in the abdomen in front of the second lumbar vertebra, called the *Receptaculum Chili*. From this reservoir the thoracic duct runs upwards as a narrow tube, lying in front of the spinal column, and empties itself into the left subclavian and internal jugular veins at the root of the neck. *See* page 9.

THE OSSEOUS SYSTEM.

THE SKULL.

The skull consists of 22 bones, some flat, others irregular, which are united by a form of dovetailing. These bones are :—

The Cranium or **Vault** - 8 bones.
- 1 Frontal Bone.
- 2 Parietal Bones.
- 2 Temporal Bones.
- 1 Occipital Bone.
- 1 Sphenoid Bone.
- 1 Ethmoid Bone.

The Face - 14 bones.
- 2 Nasal Bones.
- 2 Lachrymal Bones.
- 2 Malar Bones.
- 2 Superior Maxillæ.
- 1 Inferior Maxilla.
- 2 Palate Bones.
- 2 Turbinated Bones.
- 1 Vomer.

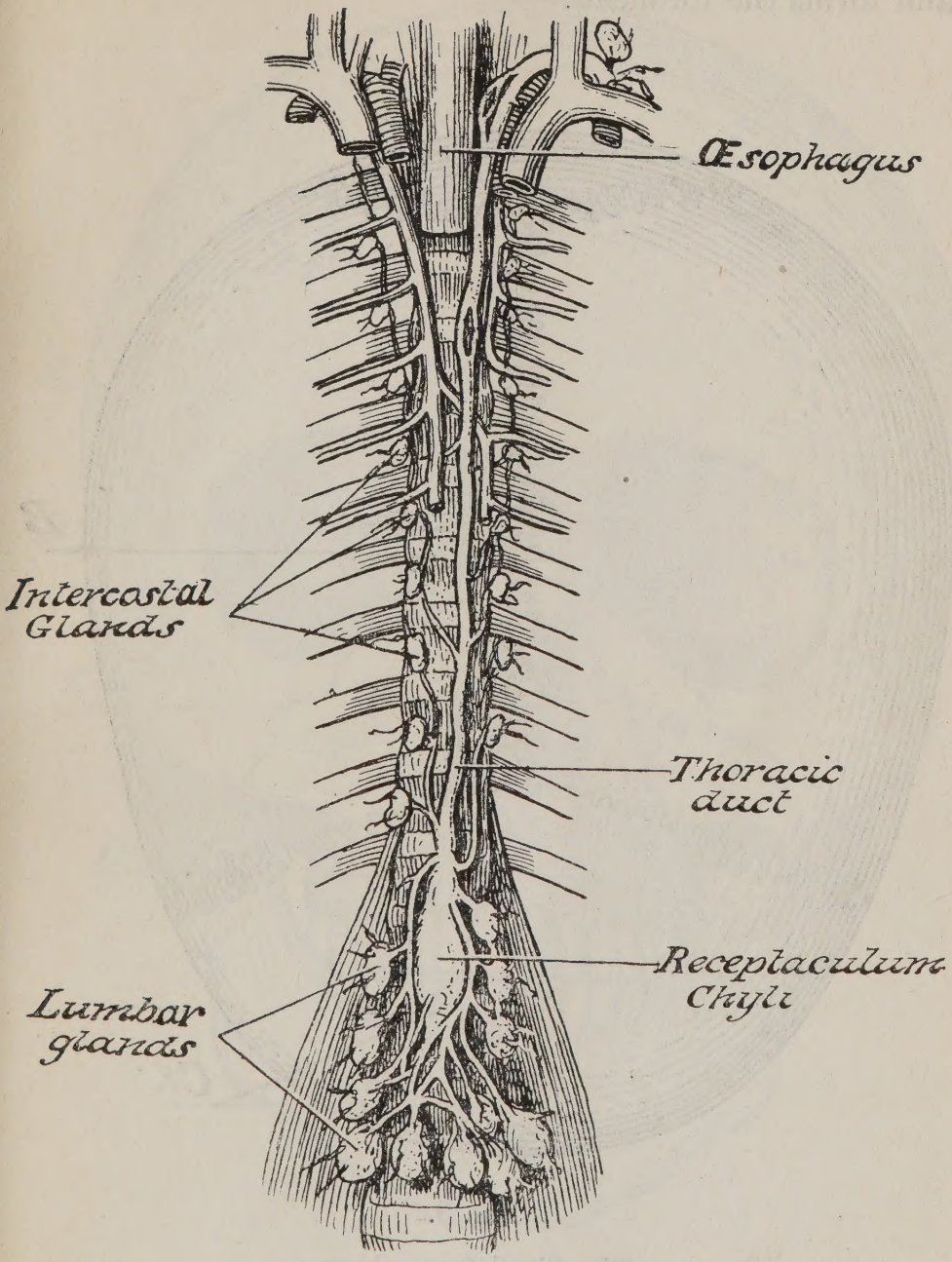


Fig. 8.

The Thoracic Duct.

The Frontal Bone is in the front of the cranium and forms the forehead.

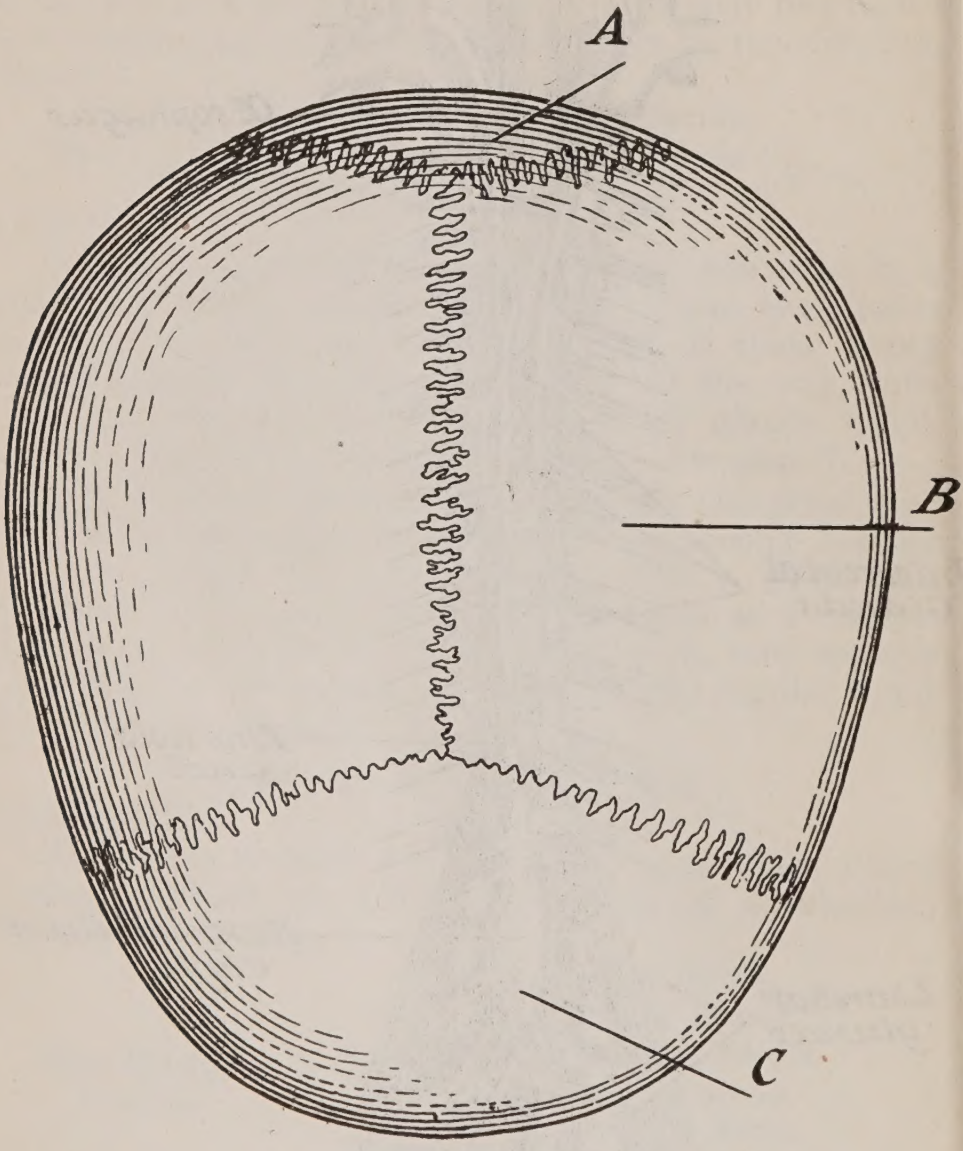


Fig. 9.

The Skull from above.

A.—Occipital Bone. B.—Parietal Bone. C.—Frontal Bone.

The Parietal Bones form the sides and roof of the cranium.

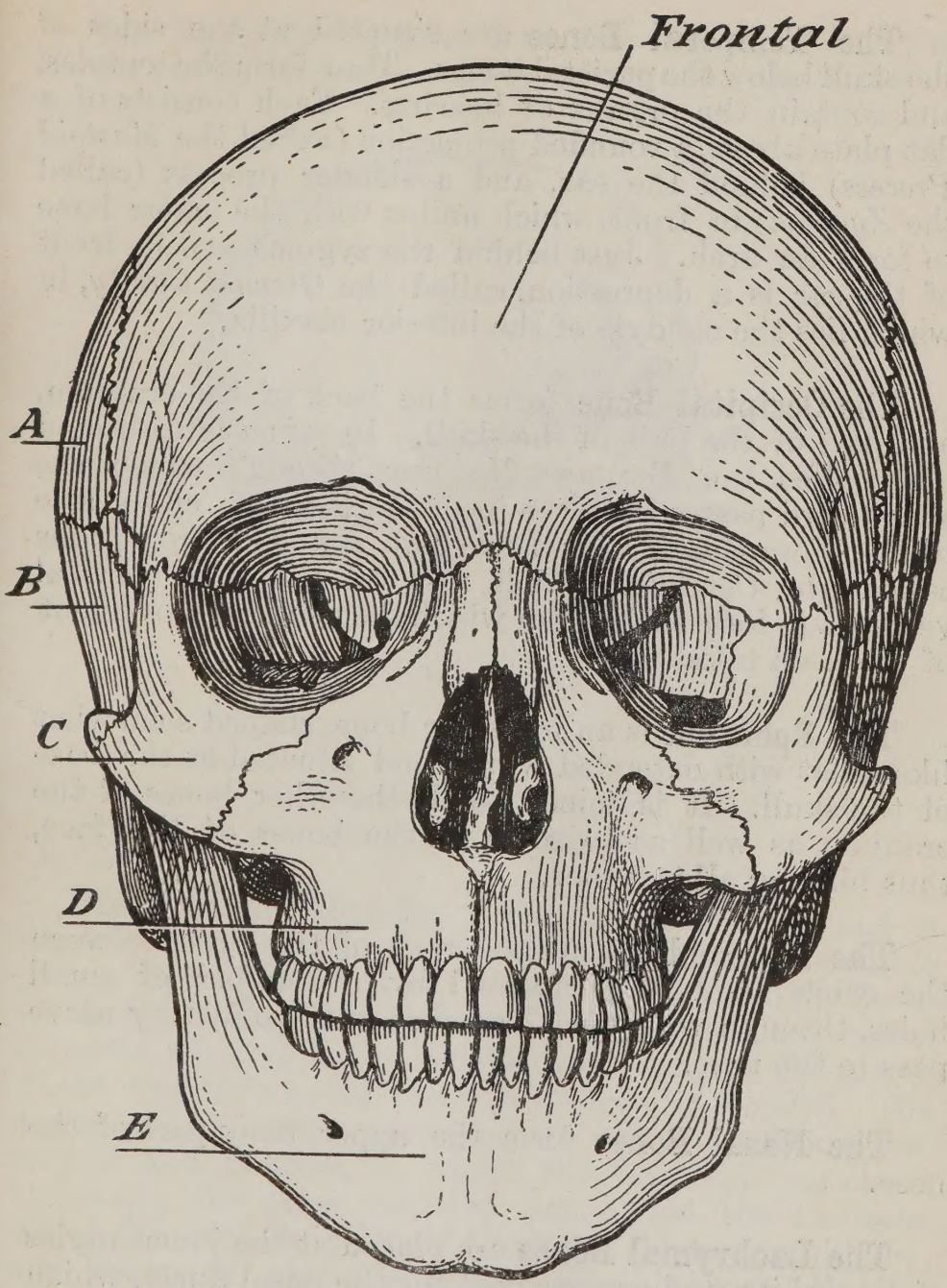


Fig. 10.

The Skull from the front.

A.—Parietal Bone. B.—Temporal Bone. C.—Malar Bone.
D.—Superior Maxilla. E.—Inferior Maxilla.

The Temporal Bones are situated at the sides of the skull below the parietal bones. They form the temples, and contain the organs of hearing. Each consists of a flat plate above, a rounded projection (called the *Mastoid Process*) behind the ear, and a slender process (called the *Zygoma*) in front, which unites with the malar bone to form an arch. Just behind the zygoma and in front of the ear is a depression, called the *Glenoid Cavity*, in which lies the condyle of the inferior maxilla.

The Occipital Bone forms the back of the cranium, and part of the base of the skull. In it is a large round hole called the *Foramen Magnum*, through which the spinal cord passes from the brain. Placed on either side of the Foramen Magnum are two rounded projections called the *Condyles*, which rest on the first cervical vertebra to form the joint at which the nodding movement of the head takes place.

The Sphenoid is an irregular bone, shaped somewhat like a bat with extended wings, and situated at the base of the skull. It is joined to all the other bones of the cranium as well as to some of the bones of the face, thus binding all together.

The Ethmoid lies at the root of the nose between the orbits, and is perforated by a number of small holes, through which the branches of the olfactory nerve pass to the nose.

The Nasal Bones form the upper bony part of the nose.

The Lachrymal Bones are placed at the inner angles of the orbits, and are grooved for the nasal ducts, which carry the tears from the eyes to the nose.

The Malar Bones form the prominences of the cheeks, and have projections which pass backwards to join the temporal bones, and so complete the zygomatic arches.

The Superior Maxillæ form the upper jaw and the front part of the palate. They contain the upper row of teeth.

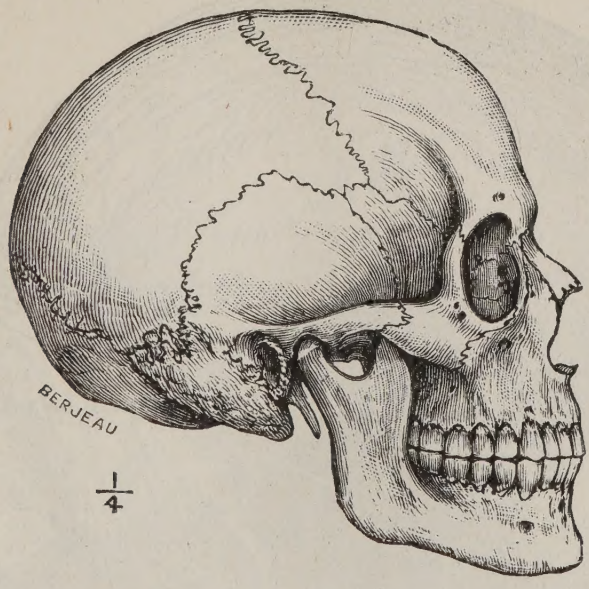


Fig. 11.
The Skull from the side.
(R.A.M.C. Training.)

The Inferior Maxilla forms the lower jaw, and is the only bone of the skull which possesses a movable joint. It consists of a horizontal part, called *the body*, which forms the chin, and two vertical portions called *the rami*, which join the body at right angles, the points where they join being called *the angles of the jaw*. The upper end of each ramus shows two projections, one narrow and pointed, to which the temporal muscle is attached; the other rounded and called the *Condyle*, which fits into the Glenoid Cavity of the temporal bone, and forms a movable joint. The Inferior Maxilla contains the lower row of teeth.

The Palate Bones form the posterior part of the roof of the mouth, and also part of the nose.

The Turbinated Bones are curved bones which project into the nostrils.

The Vomer is a thin plate of bone which forms a partition between the nostrils.

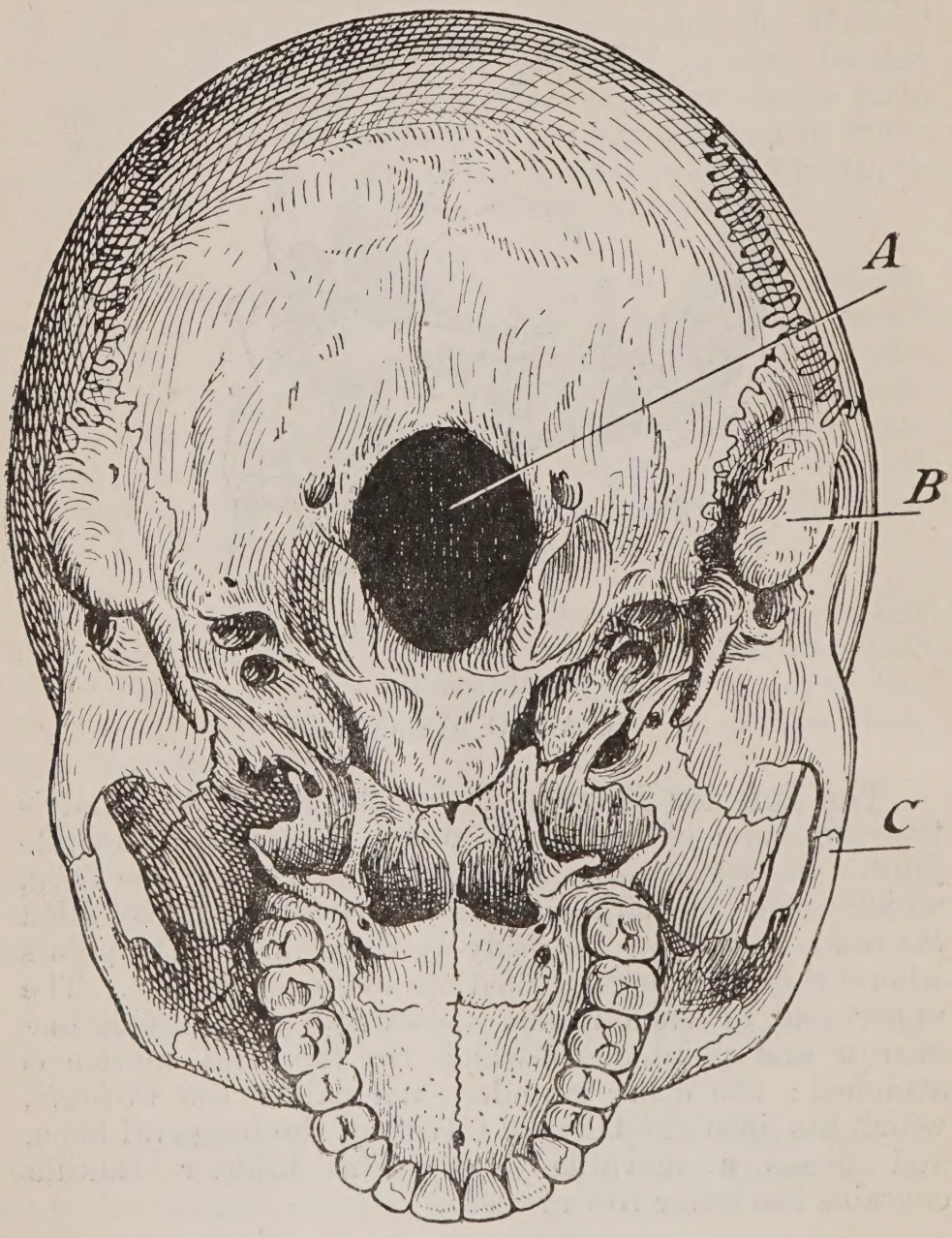


Fig. 12.

The Skull from below.

A.—Foramen magnum. B.—Mastoid Process. C.—Zygoma.

On removing the vault of the skull and looking down on the part on which the brain lies, is seen what is called

the Base of the Skull. It is divided into three parts, called *the Anterior, Middle and Posterior Fossæ*, and is perforated by numerous holes (in addition to the foramen

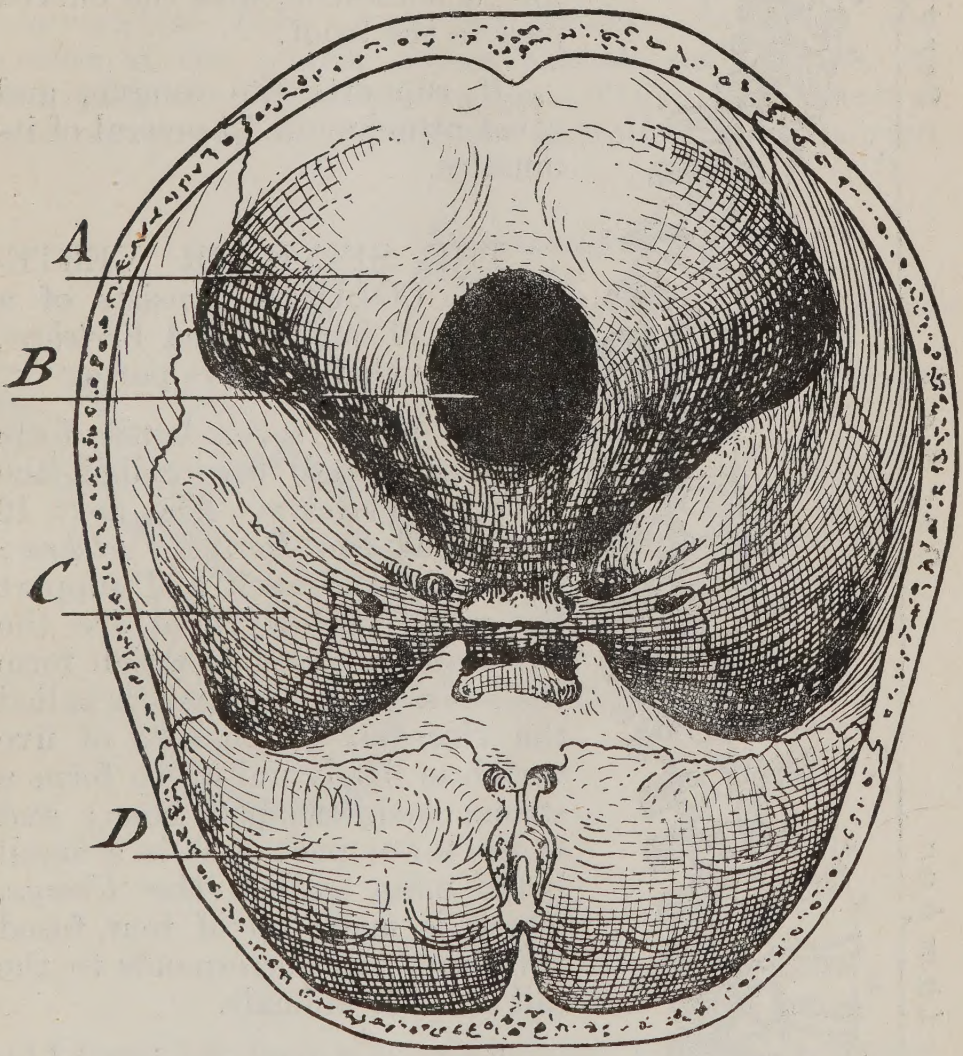


Fig. 13.

Interior of the Base of the Skull.

A.—Posterior Fossa. B.—Foramen magnum.
C.—Middle Fossa. D.—Anterior Fossa.

magnum) through which pass various nerves and blood vessels.

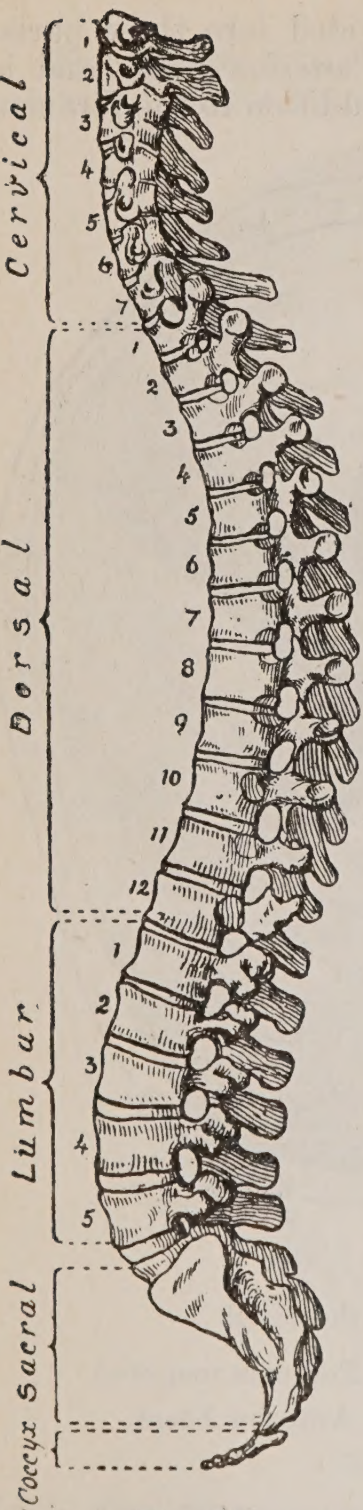


Fig. 14.
The Vertebral Column.

THE HYOID BONE is situated in the neck just below the inferior maxilla. It is shaped like a horseshoe, with the curved part to the front.

It supports the tongue, and gives attachment to several of its muscles.

THE SPINE OR VERTEBRAL COLUMN consists of a number of bones called *Vertebræ*, and is divided into five parts.

The upper seven bones form the neck, and are called the *Cervical Vertebræ*. The next 12 are called the *Dorsal Vertebræ;* they form the back and support the ribs. Below these are the five *Lumbar Vertebræ* which form the loins. The next part is called the *Sacrum*. It consists of five vertebræ firmly united to form a strong wedge-shaped bone; and at the lower part of it is a small bony mass called the *Coccyx*, which is made up of four fused vertebræ, and corresponds to the tail of other animals.

Each vertebra consists of a bony mass in front, called the body, from which spring two arches which unite behind to form a ring. From this ring three processes are given off, one at either side and one at the back; the former are called the *Transverse Processes* and the latter the *Spinous Process*. When

the vertebræ are united as in life, these rings form a canal through which the spinal cord passes.

The bodies of the vertebræ do not exactly touch one another, being separated by pads of cartilage called the *Intervertebral Discs;* but the vertebræ do touch one another at the arches, where smooth surfaces can be seen, called the *Articular Processes.* Thus all the vertebræ move one on the other (with the exception of the Sacrum

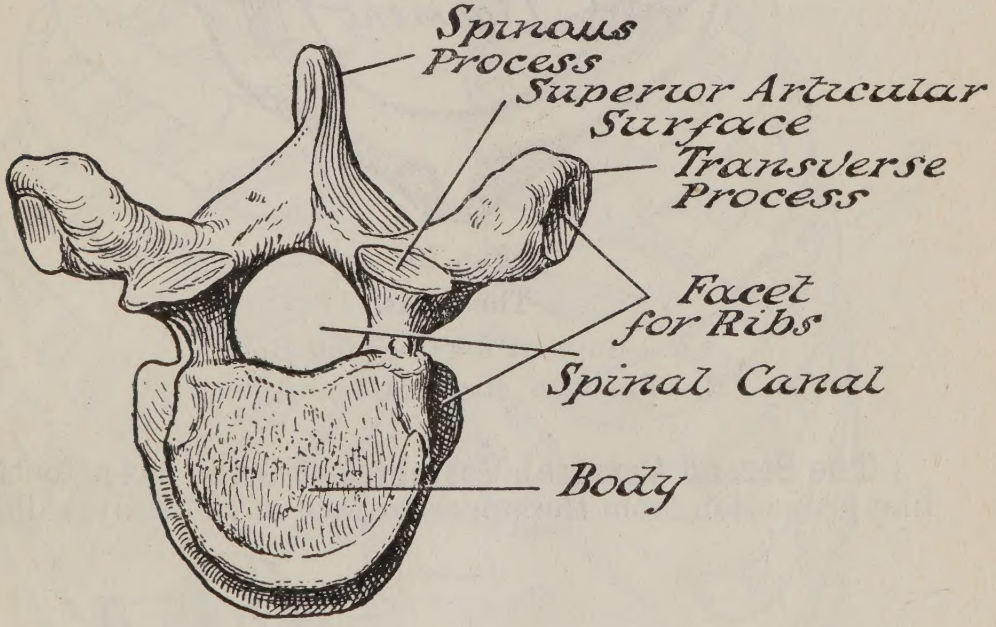


Fig. 15.

A Dorsal Vertebra.

and Coccyx) to form a supple column, but are prevented from becoming displaced by the action of strong ligaments.

Of these movable vertebræ **the Cervical** are the smallest.

The First Cervical Vertebra, or **Atlas,** has no body, and on it rest the Condyles of the Occipital Bone. At this joint the nodding movement of the head takes place. (*See* Fig. 16, page 18.)

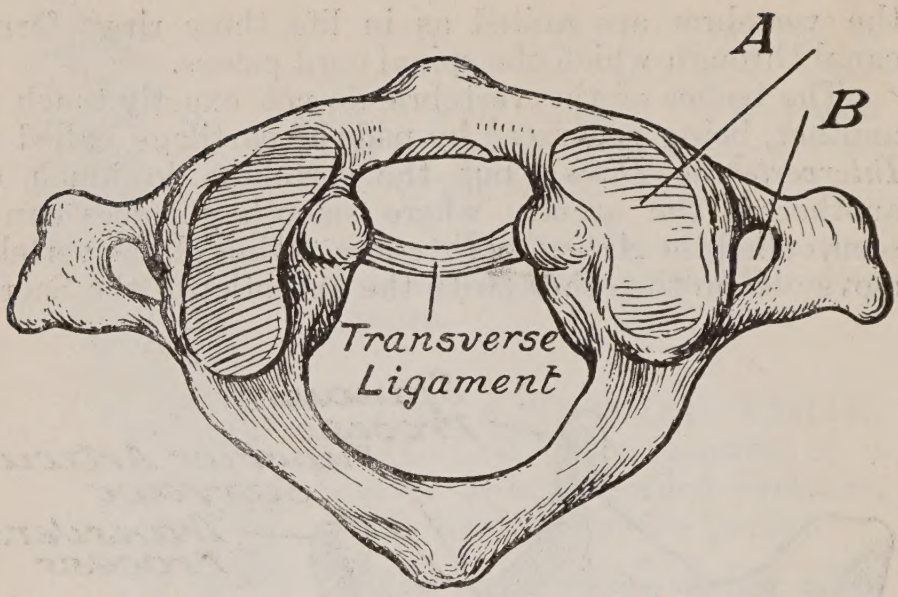


Fig. 16.

The Atlas.

A.—Support for Occipital Bone.

B.—Foramen for Vertebral Artery.

The Second Cervical Vertebra, or **Axis,** has a tooth-like projection from the upper surface of the body, called

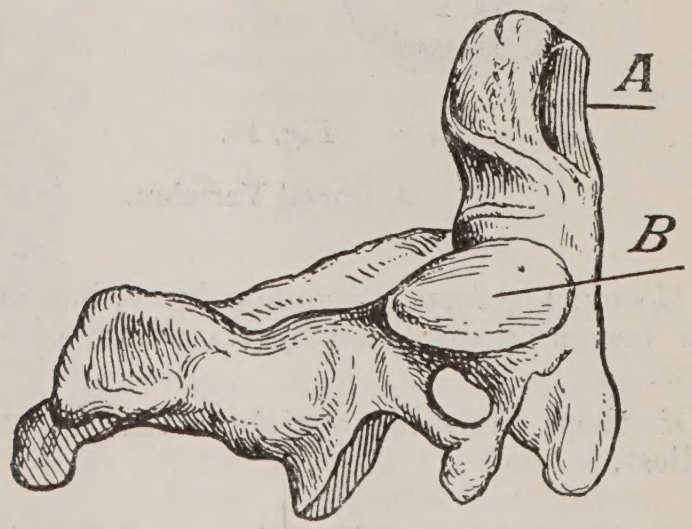


Fig. 17.

The Axis.

A.—Odontoid Process. B.—Support for Atlas.

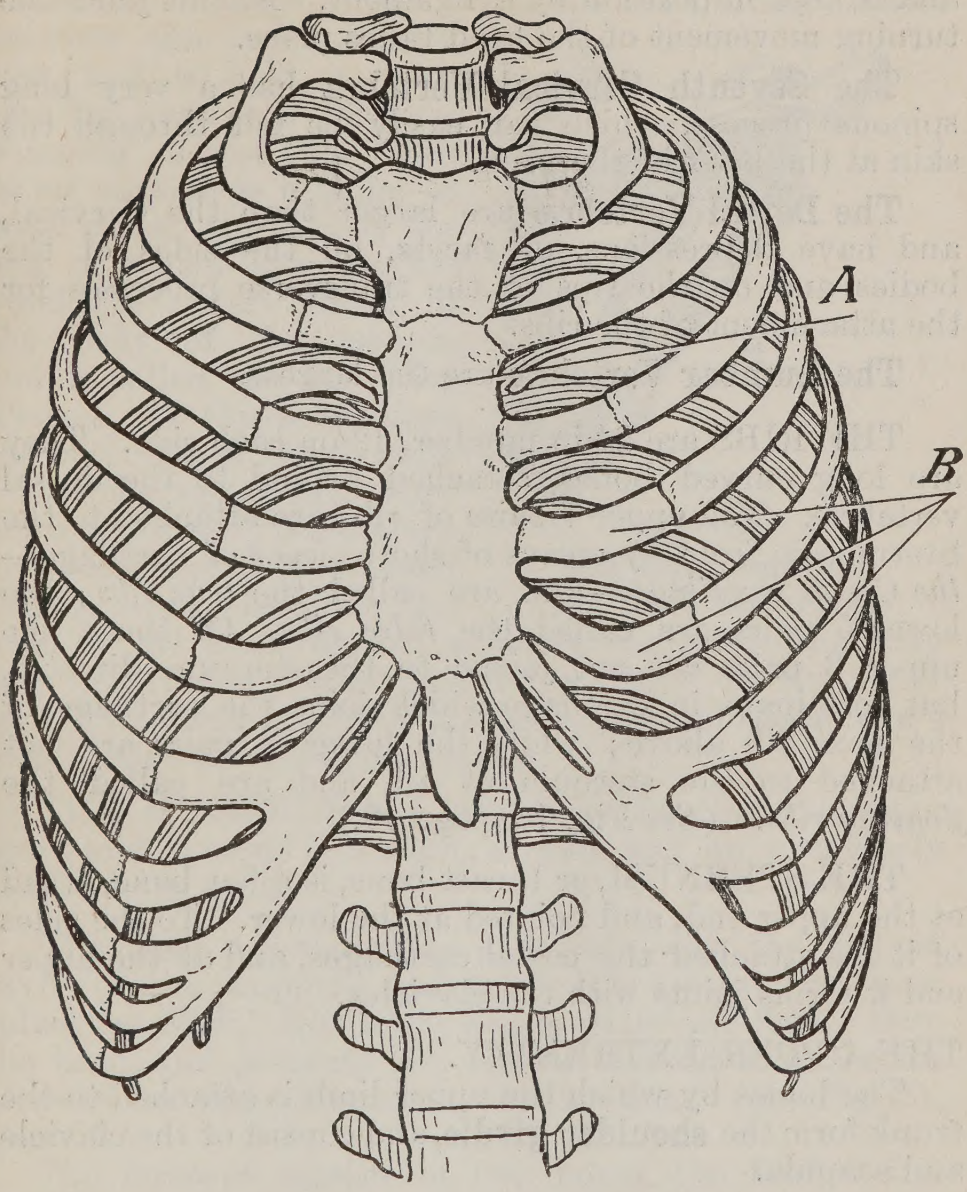


Fig. 18.

The Thorax.

A.—The Sternum. B.—Costal Cartilages.

the *Odontoid Process*, which fits into the ringlike Atlas and is kept in position by a ligament. At this joint the turning movement of the head takes place.

The Seventh Cervical Vertebra has a very long spinous process, which can easily be felt through the skin at the back of the neck.

The Dorsal Vertebræ are larger than the Cervical, and have depressions, or facets, on the sides of the bodies and on the tips of the transverse processes for the attachment of the ribs.

The Lumbar Vertebræ are the largest.

THE RIBS are 24 in number, 12 on each side. They are long curved bones, attached behind to the dorsal vertebræ. The upper 7 pairs of ribs are attached to the Sternum in front by means of short pieces of cartilage—*the Costal Cartilages*—and are called the *true ribs;* the lower 5 pairs are called the *false ribs.* Of these, the upper 3 pairs are not joined to the sternum directly, but terminate in cartilage which joins the cartilage of the next rib above; while the lower 2 pairs are not attached to the sternum at all, and are called the *floating ribs.* (*See* Fig. 18, page 19.)

THE STERNUM, or breast-bone, is a flat bone, broad at the upper end, and pointed at the lower. To the sides of it are attached the costal cartilages, and at the upper end it forms joints with the clavicles.

THE UPPER EXTREMITY.

The bones by which the upper limb is attached to the trunk form the **shoulder girdle,** and consist of the clavicle and scapula.

THE CLAVICLE, or collar-bone, is a long bone, shaped like a drawn-out S (~) which lies at the upper part of the chest above the first rib. It is attached by its inner end to the sternum, and by its outer to the acromion process of the scapula.

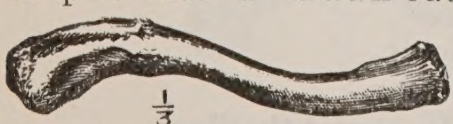


Fig. 19.
The Right Clavicle.
(R.A.M.C. Training.)

THE SCAPULA, or shoulder-blade, is a flat bone, triangular in shape, which lies at the back of the thorax between the 2nd and 7th ribs, and is held in position by numerous muscles. Running across the posterior surface is a ridge of bone called the *Spine*, the end of which projects beyond the outer border of the body of the scapula and is called the *Acromion Process*. To this is attached the outer end of the clavicle.

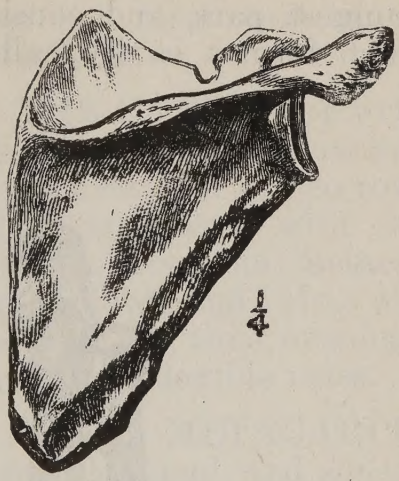


Fig. 20.
The Right Scapula.
(R.A.M.C. Training.)

At the upper and outer angle of the body is a shallow depression called the *Glenoid Cavity*, into which fits the head of the humerus, and which is attached to the body by a constricted portion called the *Neck*. At the upper part of the neck is a bony projection, shaped like a crow's beak, called the *Coracoid Process*.

THE HUMERUS is a long bone, forming the upper arm; and consists of a shaft, a head, and an irregularly shaped lower end.

The head is rounded, to articulate with the glenoid cavity of the scapula; and below it is a constricted part called the *Neck*. The lower end is wider and flatter than the head, and presents two smooth curved surfaces for articulation with the radius and the ulna. (*See* Fig. 21, page 22.)

The forearm consists of two bones, the Radius and the Ulna.

THE RADIUS is the long bone on the outer or thumb side of the forearm. The upper end articulates with the humerus, and the lower end with the carpal bones, forming the wrist joint. Just below the head is a rough prominence to which is attached the tendon of the biceps muscle. The lower end is much larger than the upper.

THE ULNA is the long bone on the inner or little finger side of the forearm. The upper end is the strongest part, and consists of two curved projections which form a cavity, called the *Sigmoid Cavity*, which

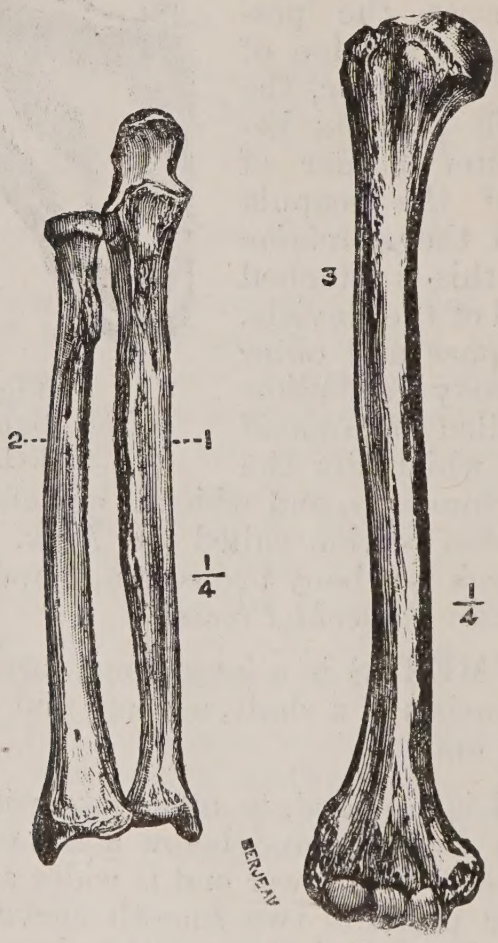


Fig. 21.

The Bones of the Right Arm and Forearm.
(R.A.M.C. Training.)

1.—Ulna. 2.—Radius. 3.—Humerus.

articulates with the lower end of the humerus. The larger of the processes, called the *Olecranon*, is behind, and prevents overextension of the elbow joint; the smaller is called the *Coronoid Process*.

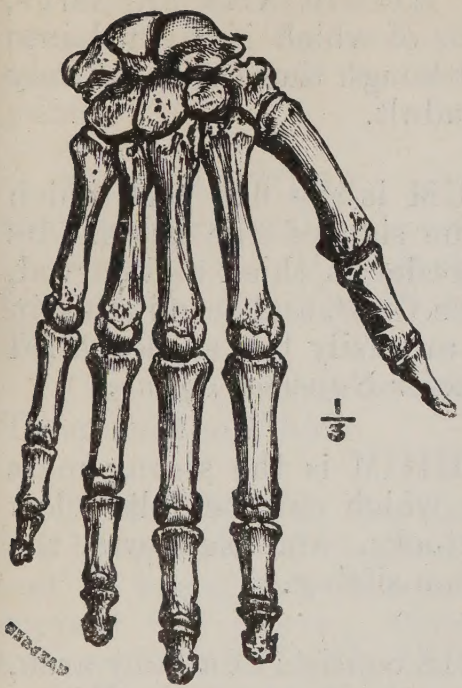


Fig. 22.
The Bones of the Right Hand. (R.A.M.C. Training.)

The lower end articulates with the radius only, and does not form part of the wrist joint.

THE CARPUS, or wrist, consists of 8 short compact bones, arranged in two rows. They articulate with the radius above, the metacarpus below, and also with one another, thus forming a strong but flexible mass.

THE METACARPUS forms the hand, and consists of 5 long bones.

THE PHALANGES form the fingers and thumb. There are 3 phalanges in each finger and 2 in the thumb—14 in all.

THE PELVIS is the bony basin at the lower part of the trunk, and is composed of four bones—the Ossa

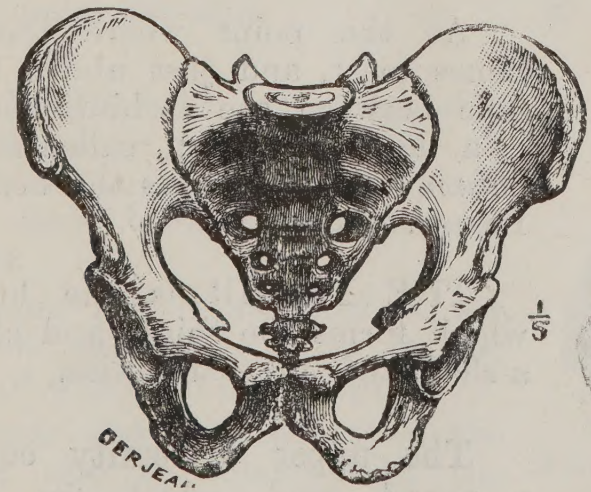


Fig. 23.—The Pelvis. (R.A.M.C. Training.)

Innominata (one on either side), and between them the Sacrum and Coccyx.

THE INNOMINATE or HIP BONES are large, irregularly-shaped bones, each of which is divided into three parts, although these are all firmly united in the adult.

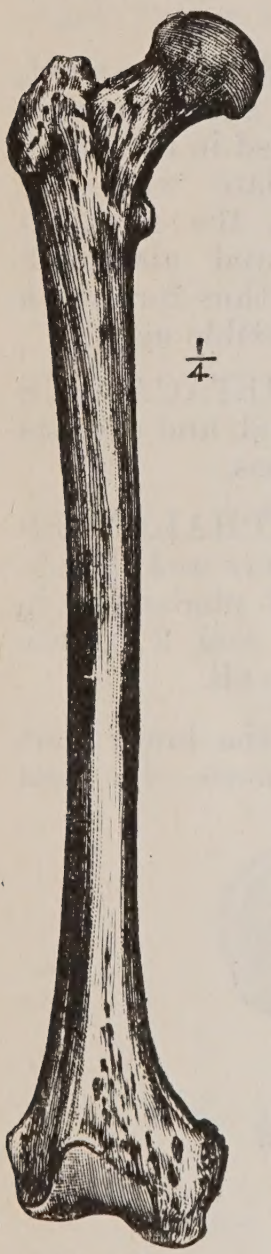


Fig. 24.

The Right Femur. (R.A.M.C. Training.)

THE ILIUM is the flat part which forms the side of the basin. Its upper border is thick and curved, called the *Crest*, and terminates in front in an easily felt angle, called the *Anterior Superior Spine*.

THE ISCHIUM is the strong mass of bone which can be felt below the buttocks, and supports the body when sitting.

THE PUBIS consists of a bony arch, and forms the front of the Pelvis. It supports the external organs of generation.

The point where the Pubes meet is called the *Symphysis Pubis*.

At the point where these three bones meet, and just above the large hole between the Ischium and Pubis, is a deep round cup, called the *Acetabulum*, into which fits the head of the Femur.

THE FEMUR is the long bone which forms the thigh, and consists of a shaft and two extremities.

The upper extremity consists of a round head, which fits into the Acetabulum, a long, constricted neck, and two prominences called the *trochanters*.

The lower extremity consists of two large, rounded masses, called the *condyles*, which rest upon the upper end of the tibia to form the knee joint.

THE PATELLA, or knee-cap, is the flat, triangular bone in front of the knee joint. It is developed in the tendon of the Quadriceps Extensor Muscle.

The leg consists of two bones, the Tibia and the Fibula.

THE TIBIA is the strong bone on the inner side of the leg. The upper end is large, and flattened on top to support the femur; while the lower end articulates with the Astragalus, and has a projection downwards at the inner side called the *Internal Malleolus*.

The front of the shaft presents a sharp border called the shin, which, like the Internal Malleolus, can be easily felt under the skin.

THE FIBULA is the long, thin bone on the outer side of the leg. It can only be felt at the upper and lower ends, the shaft being deeply covered by muscles.

The upper end is attached to the Tibia below the knee joint, in the formation of which it takes no part.

The lower end is attached to the Tibia, and also articulates with the Astragalus. This end forms the prominence at the outer side of the ankle joint, and is called the *External Malleolus*.

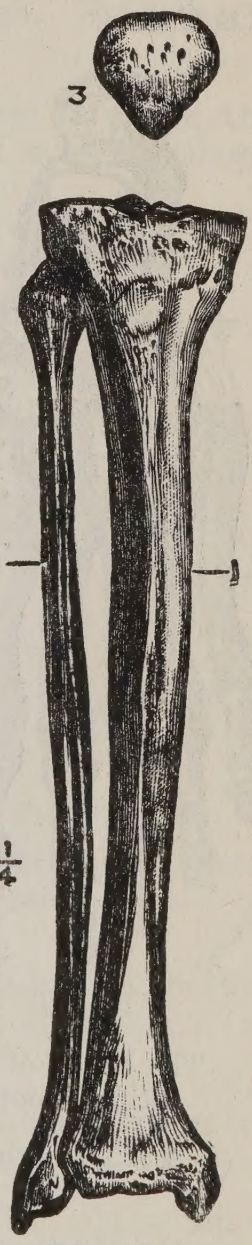


Fig. 25.
The Bones of the Right Leg. (R.A.M.C. Training.)
1.—Tibia.
2.—Fibula.
3.—Patella

THE TARSUS, or ankle, consists of seven bones, the most important of which are the Astragalus and the Os Calcis.

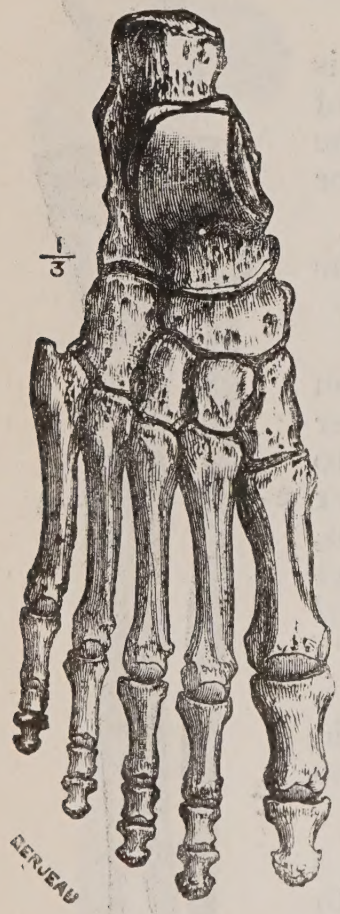


Fig. 26.

The Bones of the Right Foot.

(R.A.M.C. Training.)

THE ASTRAGALUS is the bone which forms the ankle joint by articulation with the lower ends of the Tibia and Fibula.

THE OS CALCIS is the prominent bone forming the heel.

THE METATARSUS forms the foot, and consists of five long bones.

THE PHALANGES form the toes. There are 2 phalanges in the great toe, and 3 in each of the others—14 in all.

JOINTS.

A Joint, or **Articulation,** is formed where two or more bones meet, and may be movable or immovable.

I. IMMOVABLE JOINTS, or Sutures, are formed by the firm contact of two bones without any intervening cartilage. They occur between the various bones in the cranium and face, with the exception of the Inferior Maxilla.

II. MOVABLE JOINTS are those in which movement of the bones can take place, and the ends of the bones are always separated by pads of cartilage. They may be imperfect or perfect.

(1) Imperfect Movable Joints are those in which the bones are separated by a single pad of

cartilage, and there is no synovial membrane. Movement is very limited, and is chiefly due to the elasticity of the cartilage. Such joints occur between the vertebræ.

(2) Perfect Movable Joints are those in which the end of each bone is covered with cartilage, and the cartilages separated by synovial membrane.

The Synovial Membrane is a thin, delicate tissue, forming a closed sac, and containing a lubricating fluid, like white of egg, called *Synovial Fluid.* These joints are also completely surrounded by a *capsule* of strong fibrous tissue.

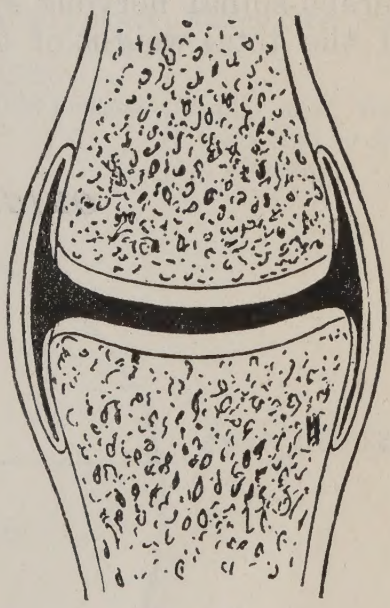


Fig. 27.
Section through a Perfect Movable Joint.

There are four varieties of perfect movable joints:—

(*a*) **Ball and Socket Joints** consist of a rounded head fitting into a hollow socket, as in the hip and shoulder, and allow movement in every direction.

(*b*) **Hinge Joints** allow movement only in one direction, as in the elbow and knee.

(*c*) **Gliding Joints** have two plane surfaces which glide upon each other, as those between the bones of the carpus and tarsus.

(*d*) **Pivot Joints** are those in which one bone forms a pivot around which the other rotates, as in the joint between the atlas and axis.

THE MUSCULAR SYSTEM.

The Muscles of the body are divided into two groups, voluntary and involuntary.

VOLUNTARY MUSCLES are those which can be put into action and controlled by the will, through the cerebo-spinal nervous system. They form 40 per cent. of the total weight of the body, and most of them are

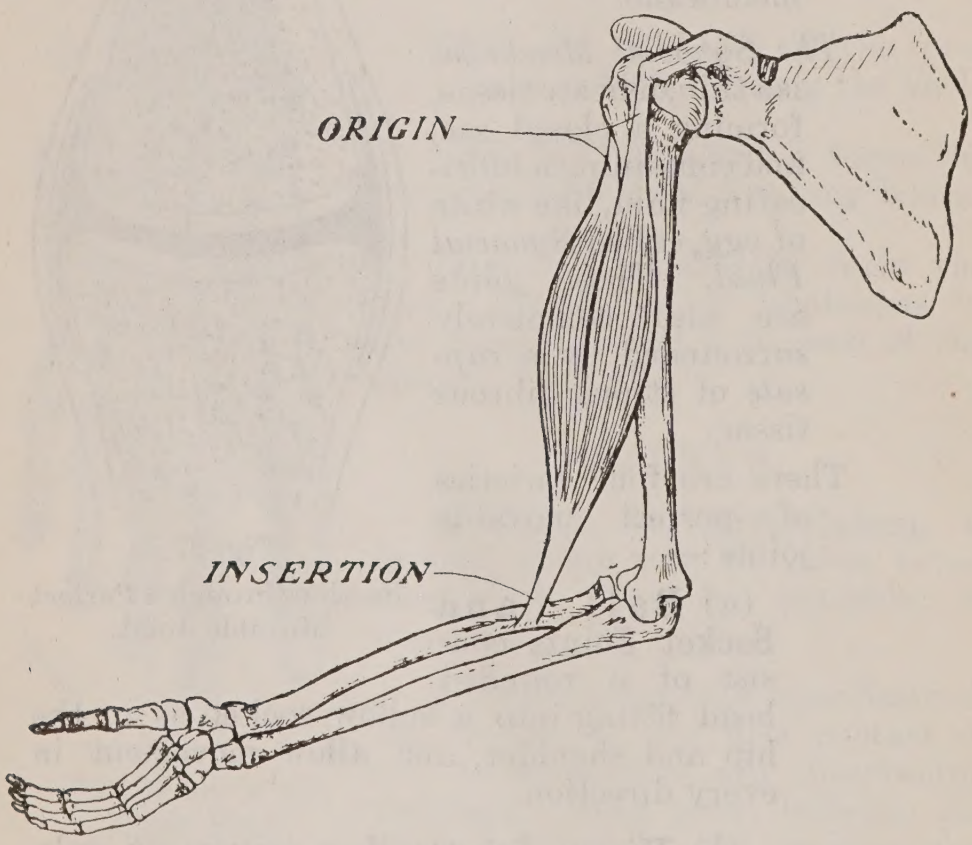


Fig. 28.
The Biceps Muscle.

attached to the bones. One end of a muscle is attached to a fixed bone, and is called its *origin;* the other end is attached to a moveable bone, and is called its *insertion.* Muscles are inserted into bones by means of *tendons,* which are strong, glistening bands of fibrous tissues connecting the muscle and bone. Muscles which

bend a limb at a joint are called *flexors*, and those which straighten it are called *extensors*.

Name.	*Origin.*	*Insertion.*	*Action.*
	MUSCLES OF THE HEAD AND NECK.		
Temporal -	Temporal bone -	Coronoid process of inferior maxilla.	Raises lower jaw.
Sterno-mastoid.	Upper end of sternum and inner end of clavicle.	Mastoid process	Bends head forward and to opposite side.

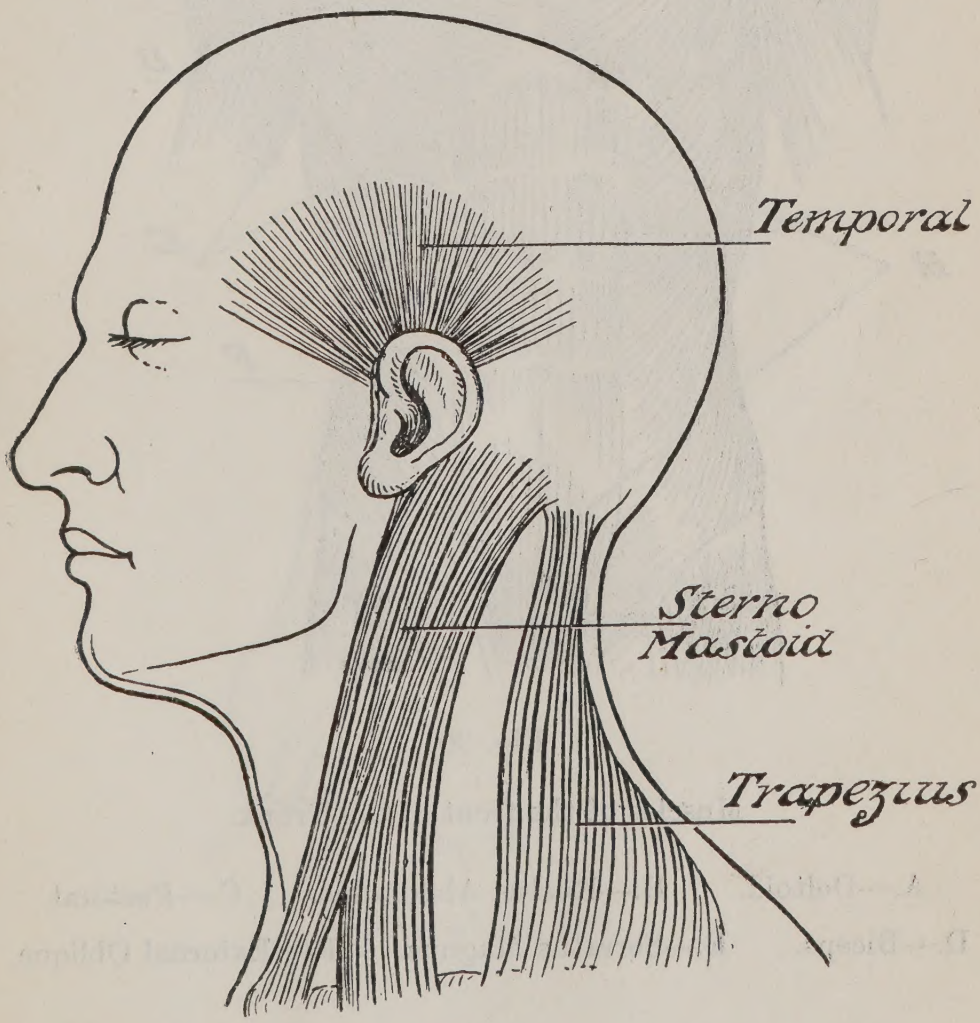


Fig. 29.
Muscles of the Head and Neck.

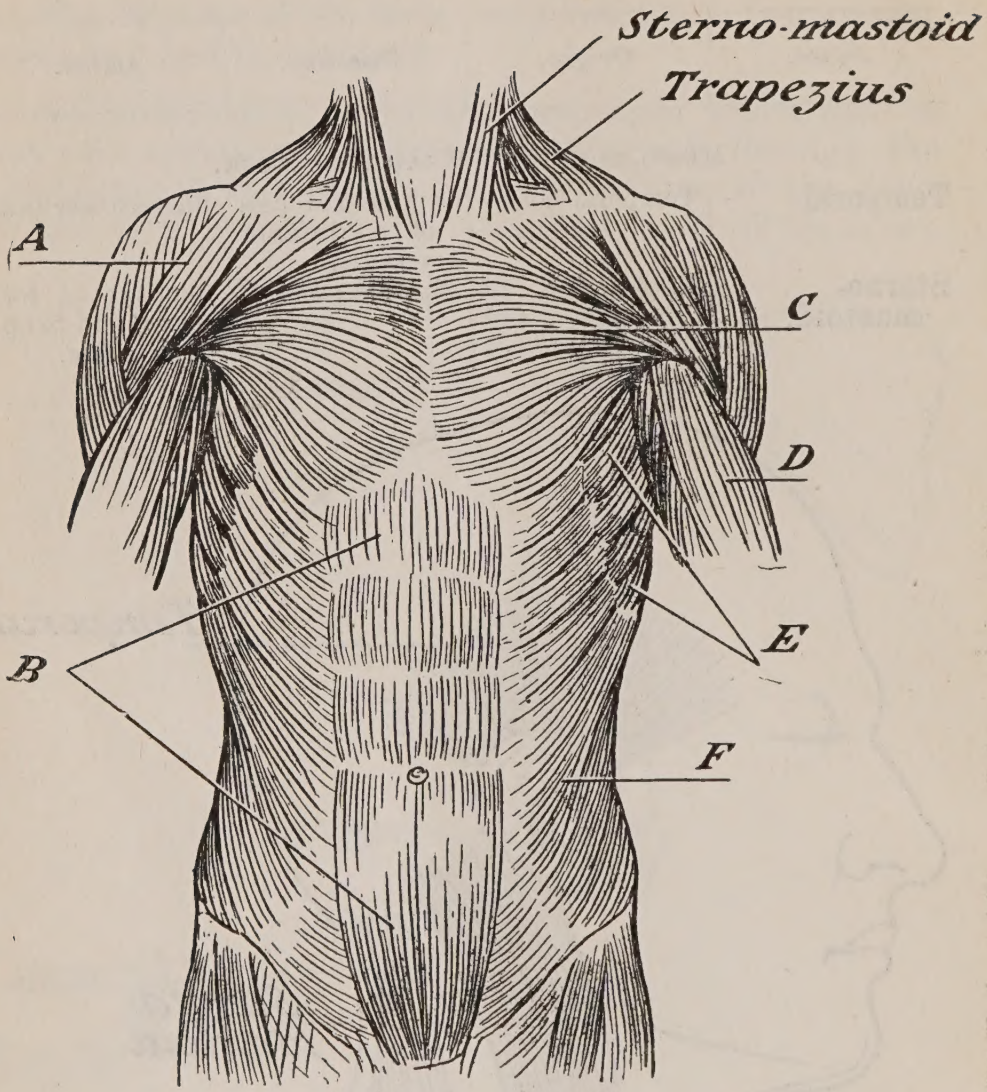


Fig. 30.

Muscles of the front of the Trunk.

A.—Deltoid. B.—Rectus Abdominis. C.—Pectoral.
D.—Biceps. E.—Serratus Magnus. F.—External Oblique.

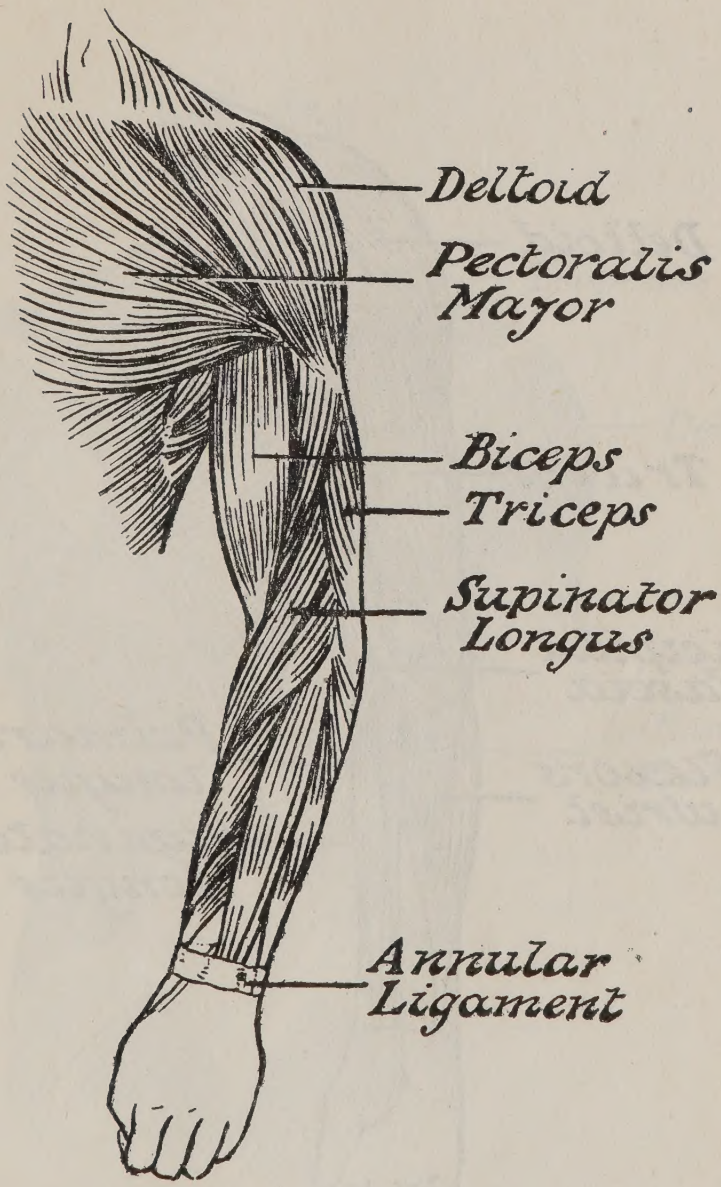


Fig. 31.

Muscles of the Arm.

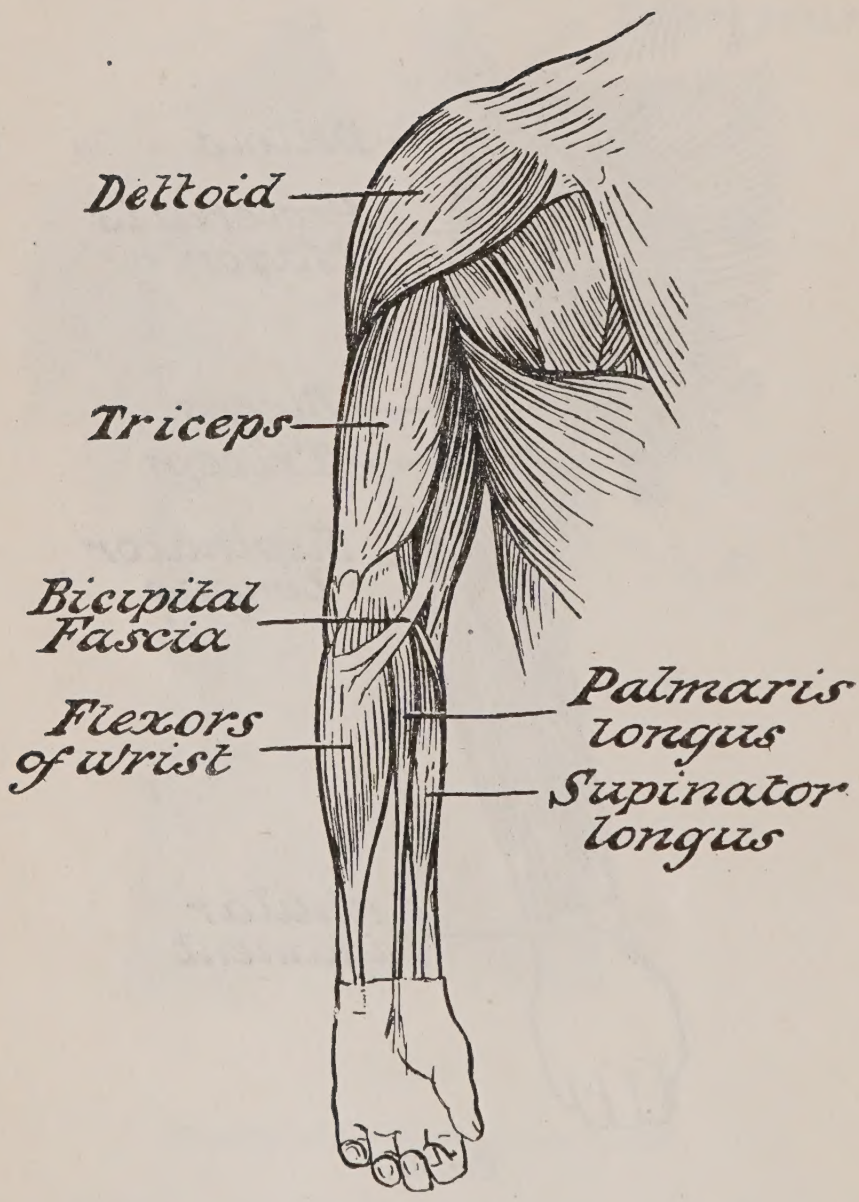


Fig. 32.

Muscles of the Arm.

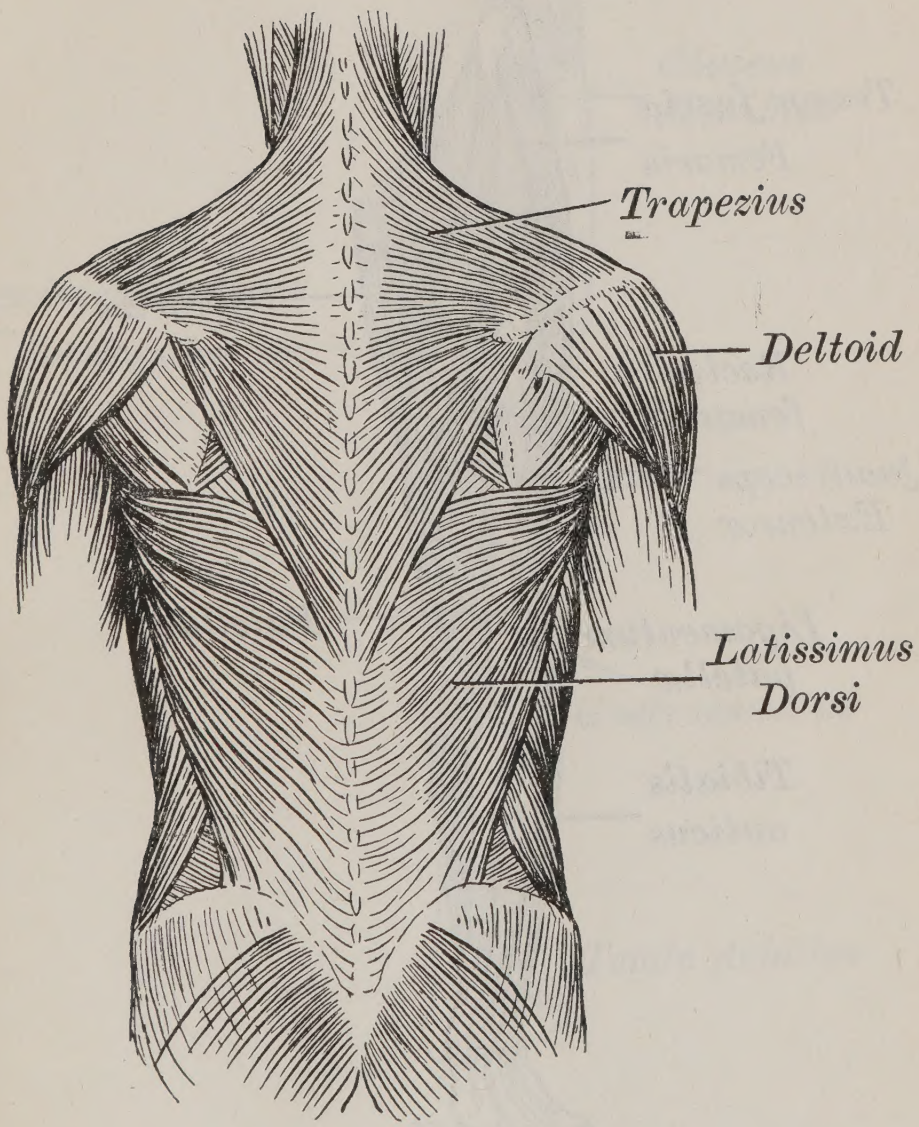


Fig. 33.

Muscles of the back of the Trunk.

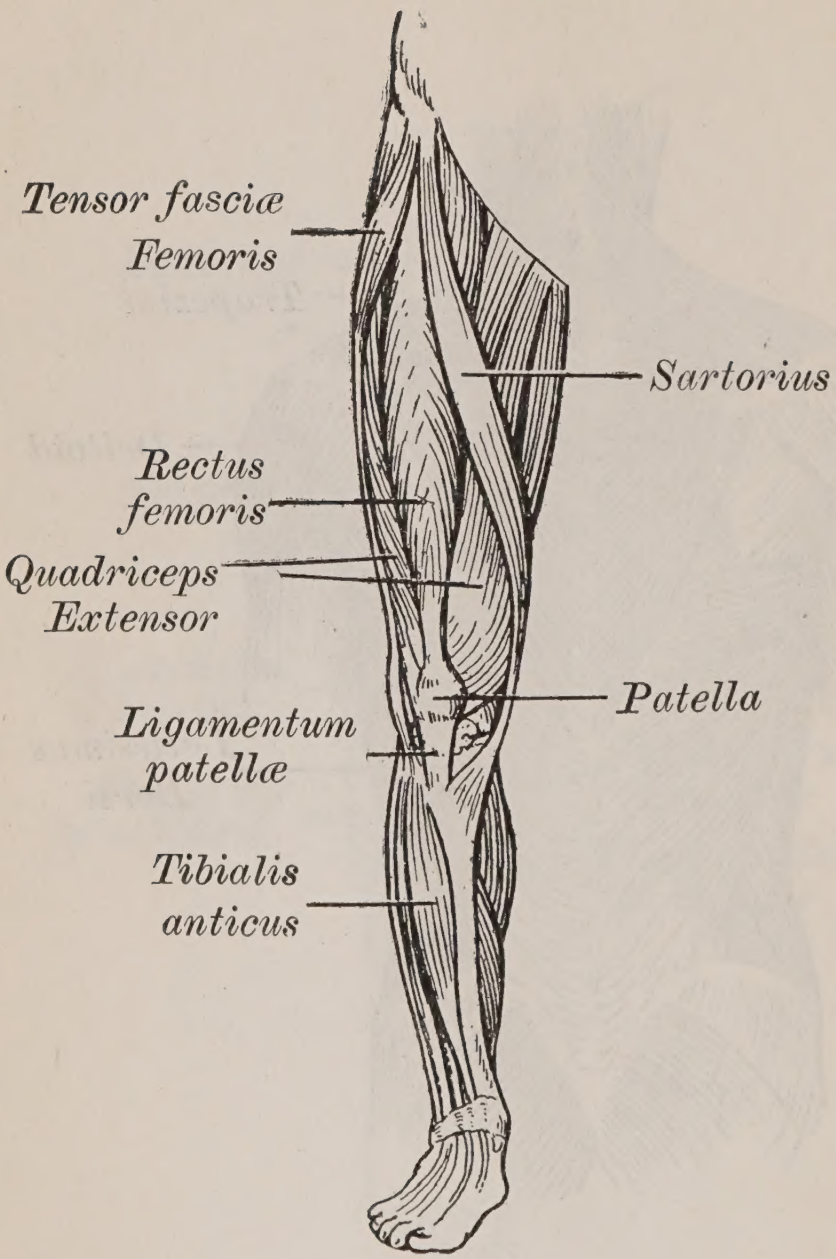


Fig. 34.

Muscles of the front of the Leg.

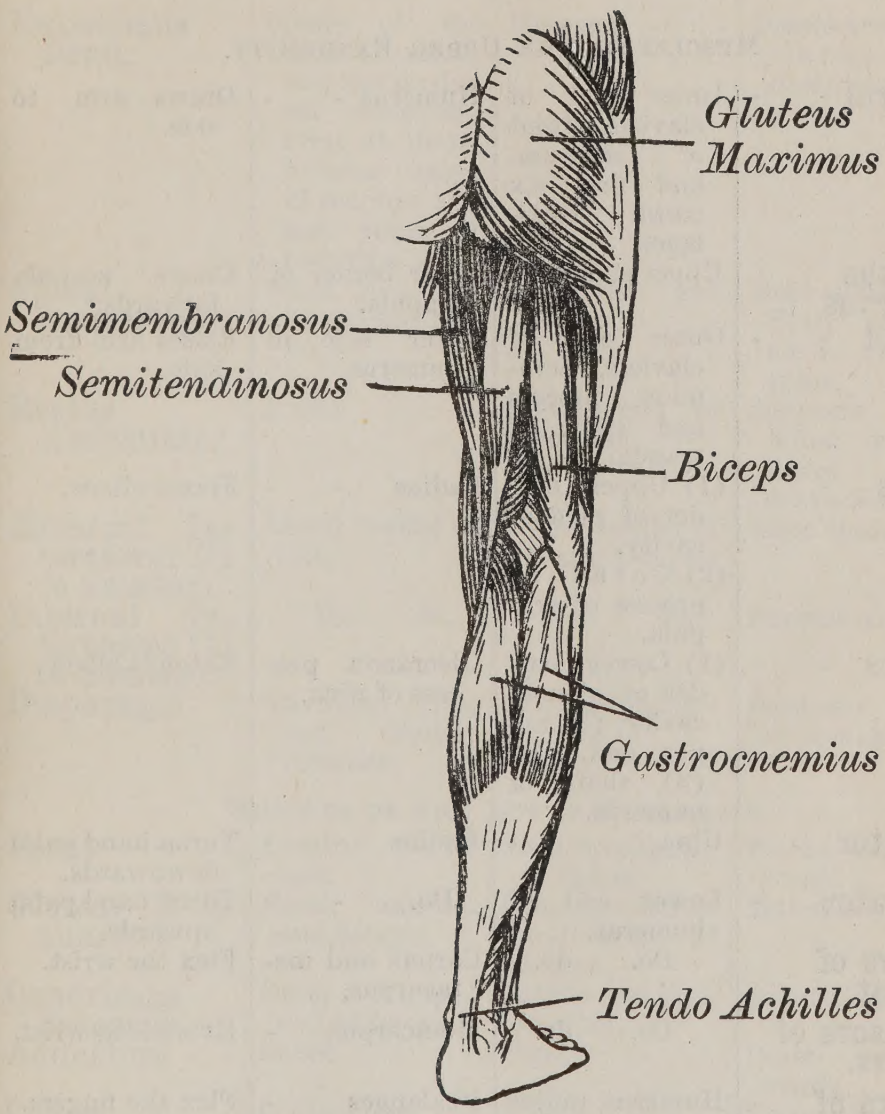


Fig. 35.

Muscles of the back of the Leg.

Name.	*Origin.*	*Insertion.*	*Action.*
	MUSCLES OF THE UPPER EXTREMITY.		
Pectoral - -	Inner end of clavicle, front of sternum, and first six costal cartilages.	Humerus - -	Draws arm to side.
Serratus Magnus	Upper eight ribs	Inner border of scapula.	Draws scapula forwards.
Deltoid - -	Outer end of clavicle, acromion process and spine of scapula.	Outer side of humerus.	Raises arm from side.
Biceps - -	(1) Upper border of glenoid cavity. (2) Coracoid process of scapula.	Radius - -	Flexes elbow.
Triceps - -	(1) Lower border of glenoid cavity, (2) upper end, and (3) shaft of humerus.	Olecranon process of ulna.	Extends elbow.
Pronator -	Ulna - -	Radius - -	Turns hand palm downwards.
Supinator -	Lower end of humerus.	Do. - -	Turns hand palm upwards.
Flexors of Wrist.	Do. do.	Carpus and metacarpus.	Flex the wrist.
Extensors of Wrist.	Do. do.	Metacarpus -	Extend the wrist.
Flexors of Fingers.	Humerus, radius and ulna.	Phalanges -	Flex the fingers.
Extensors of Fingers.	Do. do.	Do. -	Extend the fingers.
	MUSCLES OF THE TRUNK.		
Trapezius -	Occiput; spinous processes of cervical and dorsal vertebræ.	Outer end of clavicle and acromion process of scapula.	Draws scapula backwards (braces shoulders).

Name.	*Origin.*	*Insertion.*	*Action.*
Latissimus Dorsi.	Spines of the sacral, lumbar, and last six dorsal vertebræ; crest of ilium, inferior angle of scapula, and last three or four ribs.	Humerus - -	Draws arm backwards and downwards.
Spinal (numerous).	Skull, ribs, vertebræ and pelvis.	Vertebræ and skull.	Hold spine erect. Flex, extend, and rotate spine.
Rectus Abdominis.	Pubes - -	Lower end of sternum.	Supports abdominal viscera; flexes spine; draws down ribs.
External Intercostal (11 in number).	Lower border of rib.	Upper border of next rib below.	Raise the ribs.
Internal Intercostal (11 in number).	Do. do.	Do. do.	Depress the ribs.
Diaphragm -	Sternum, ribs, and lumbar vertebræ.	Central tendon -	Increases height of thorax.
	MUSCLES OF THE LOWER EXTREMITY.		
Psoas - -	Lumbar vertebræ.	Small trochanter of femur.	Flexes thigh on trunk.
Gluteal (3 in number).	Ilium, sacrum and coccyx.	Great trochanter and shaft of femur.	Extends thigh.
Quadriceps Extensor.	Ilium and upper end of femur.	Patella and then to tibia.	Extends knee.
Adductors -	Pubes - -	Femur - -	Draw leg inwards.
Biceps - -	(1) Ischium, (2) Femur.	Fibula - -	Flexes the knee.
Tibialis Anticus.	Tibia - -	Tarsus - -	Flexes the ankle.
Tibialis Posticus.	Tibia and fibula	Do. - -	Extends the ankle.
Gastrocnemius	Lower end of femur.	Os calcis - -	Do. do.
Flexors of Toes.	Tibia and fibula	Phalanges - -	Flex the toes.
Extensors of Toes.	Do. do.	Do. - -	Extend the toes.

INVOLUNTARY MUSCLES are those over which the will has no control, but are supplied by branches from the sympathetic nervous system. They are found in the blood vessels, stomach, intestines, bladder, and the eye.

The heart is an involuntary muscle, although it is composed of striated muscular tissue.

CAVITIES OF THE BODY.

There are three large cavities of the body :—

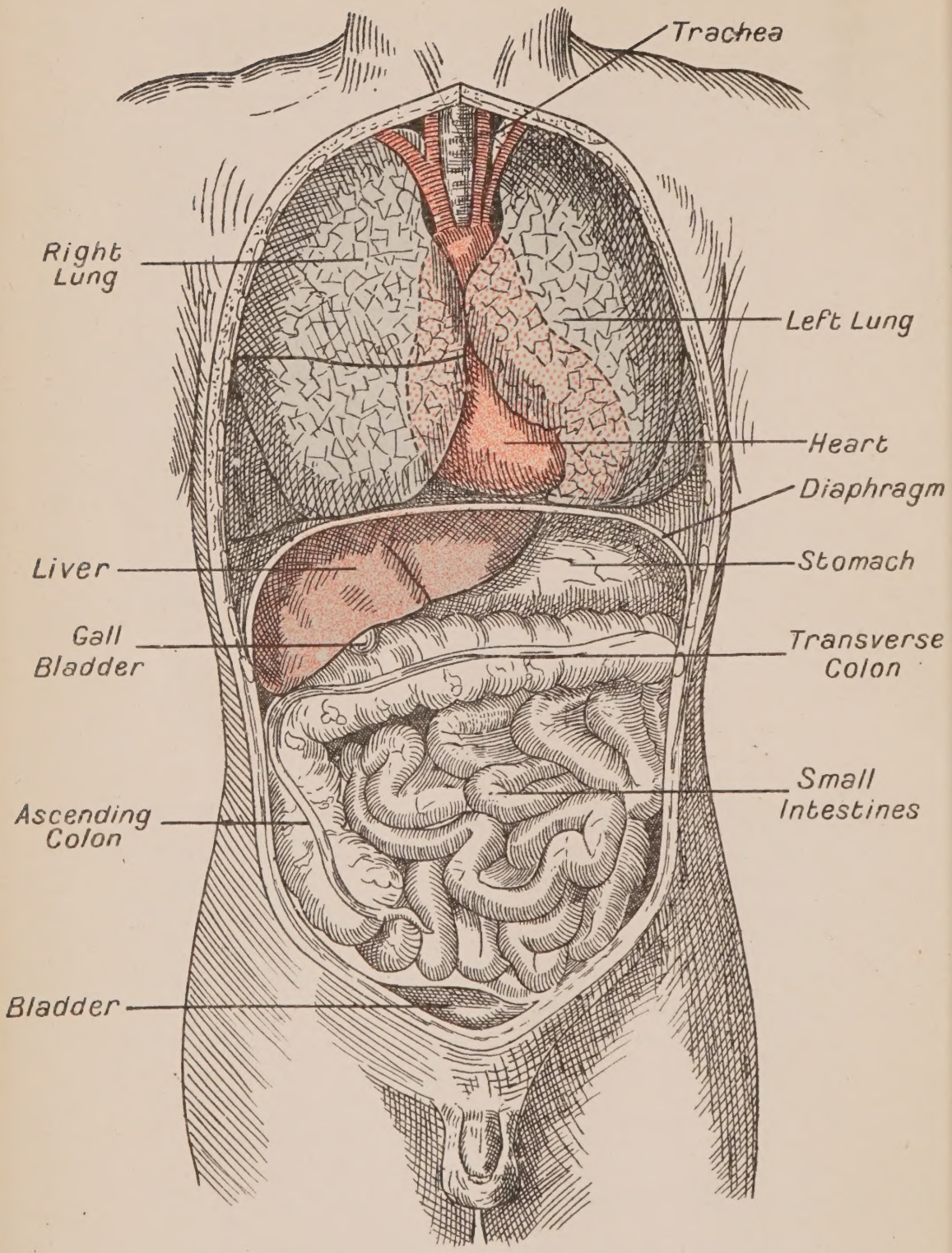
1. The cerebro-spinal cavity.
2. The thoracic cavity.
3. The abdominal cavity.

1. The Cerebro-spinal Cavity is bounded by the bones of the cranium and by the bony rings of the vertebræ. It contains—

(*a*) The cerebrum.
(*b*) The cerebellum.
(*c*) The medulla oblongata.
(*d*) The pons Varolii.
(*e*) The spinal cord.

2. The Thoracic Cavity is the cone-shaped space commonly called the chest. It is bounded in front by the sternum and costal cartilages; at the sides by the ribs; behind by the vertebræ and ribs; and below by the diaphragm, which arches upwards into the thorax. At the upper end is an opening through which pass the trachea, œsophagus, blood vessels and nerves. It contains—

(*a*) The heart.
(*b*) The lungs.
(*c*) The trachea.
(*d*) The œsophagus.
(*e*) The large blood vessels which enter and leave the heart.
(*f*) Nerves.
(*g*) The thoracic duct.



CONTENTS OF THORAX & ABDOMEN

Fig 36.

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Malby & Sons, Lith.

3. The Abdominal Cavity is generally described as being divided into the abdomen proper and the pelvis, but there is no definite line of division.

(1) The Abdomen proper is bounded in front and at the sides by the abdominal muscles, the lower ribs, and the iliac bones; behind by the vertebræ and lumbar muscles; above by the diaphragm; and below by the brim of the pelvis. It contains—

(*a*) The stomach.
(*b*) The small intestines.
(*c*) The large intestines.
(*d*) The liver.
(*e*) The pancreas.
(*f*) The spleen.
(*g*) The kidneys with the ureters.
(*h*) The aorta and its branches.
(*i*) The inferior vena cava and its tributaries.
(*j*) The thoracic duct.
(*k*) Nerves, spinal and sympathetic.

(2) The Pelvis is bounded in front by the pubes; at the sides by the ischia; behind by the sacrum and coccyx; below by various muscles; and above by the brim of the pelvis. It contains—

(*a*) The bladder.
(*b*) The rectum.
(*c*) Some of the organs of generation.
(*d*) Blood vessels.
(*e*) Nerves.

THE ORGANS OF CIRCULATION.

The Organs of Circulation consist of the heart and blood vessels.

THE HEART is a hollow muscular organ situated in the thorax between the lungs. It is 5 inches in length; $3\frac{1}{2}$ inches in breadth, $2\frac{1}{2}$ inches in thickness, and weighs

about 10 ounces. It is conical in shape, the base being directed upwards, backwards and to the right; and the apex downwards, forwards and to the left. The beat of the apex against the chest wall can be felt in the space between the fifth and sixth ribs, at a point $1\frac{1}{2}$ inches below and 1 inch internal to the left nipple.

The heart is contained in a fibrous bag called the *Pericardium*, the inner surface of which secretes peri-

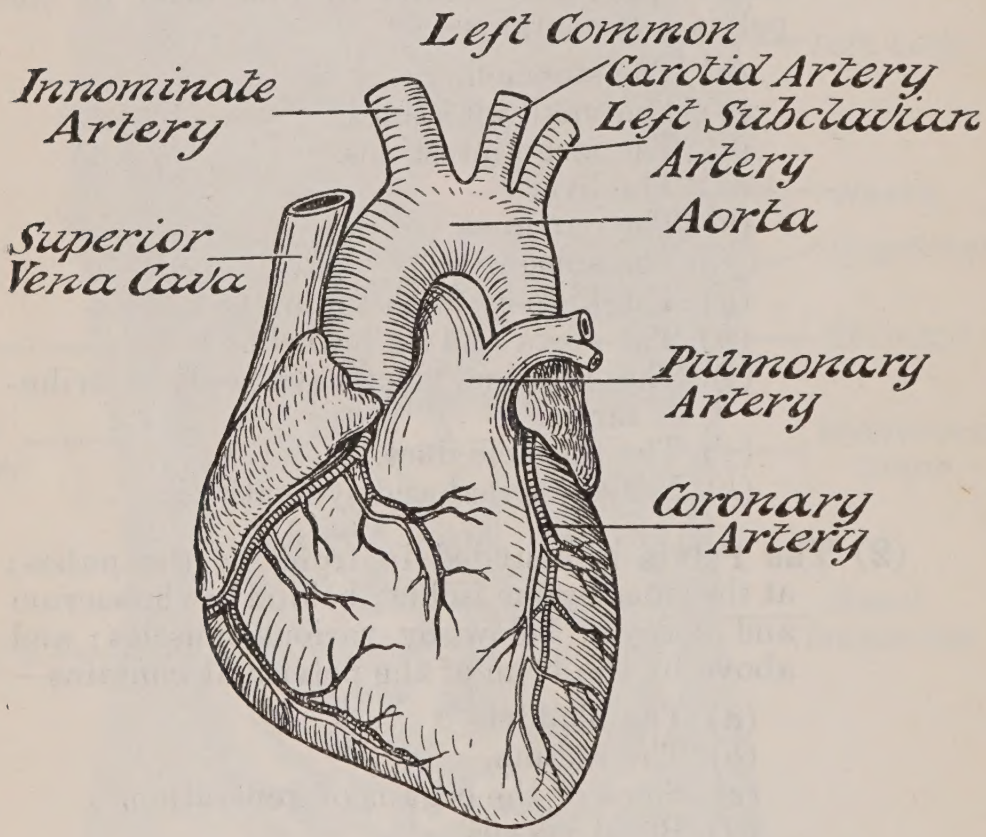


Fig. 37.

The Heart and main Blood-vessels.

cardial fluid which prevents friction with the heart itself.

The heart is divided longitudinally into two halves, the right and the left, by a muscular wall; and there is no direct communication between these halves. Each side is again divided into two, the upper and smaller chambers being called the *Auricles*, and the lower and

larger the *Ventricles;* and there is an opening leading from the auricle to the ventricle of each side. There are thus four chambers—the right and left auricles and the right and left ventricles; and each chamber has an opening through which the blood enters and another through which it leaves.

The Right Auricle has thin walls and a capacity of about 2 ounces. Blood enters it from the Superior and Inferior Venæ Cavæ, and passes by the *auriculo-ventricular orifice* into the right ventricle. This orifice is guarded by the *tricuspid valve*, which prevents the blood flowing backwards from the ventricle to the auricle.

The Right Ventricle has thick walls and a capacity of about 3 ounces. Blood enters it from the Right Auricle through the *tricuspid valve* and leaves it by the opening leading into the Pulmonary Artery. This opening is guarded by the *semilunar valves*, which prevent the blood flowing backwards from the pulmonary artery into the ventricle.

The Left Auricle has thin walls and a capacity of about 2 ounces. Blood enters it from the four Pulmonary Veins and passes by the *auriculo-ventricular orifice* into the Left Ventricle. This orifice is guarded by the *bicuspid valve*, which prevents the blood flowing backwards from the ventricle to the auricle.

The Left Ventricle has very thick walls and a capacity of about 3 ounces. Blood enters it from the left auricle through the *bicuspid valve* and leaves it by the opening leading into the Aorta. This opening is guarded by the *semilunar valves*, which prevent the blood flowing backwards from the aorta into the ventricle.

Heart muscle is peculiar in that it is composed of striated muscular tissue which is not controlled by the will. It receives its blood supply by the Coronary Arteries which arise from the aorta near the semilunar valve, and its nerve supply from the cranial and sympathetic nerves.

THE BLOOD VESSELS are of three kinds:—arteries, capillaries, and veins.

ARTERIES are the vessels through which blood is carried from the heart, and are composed of three coats.

(*a*) **The Outer Coat** is thin and composed of connective tissue.

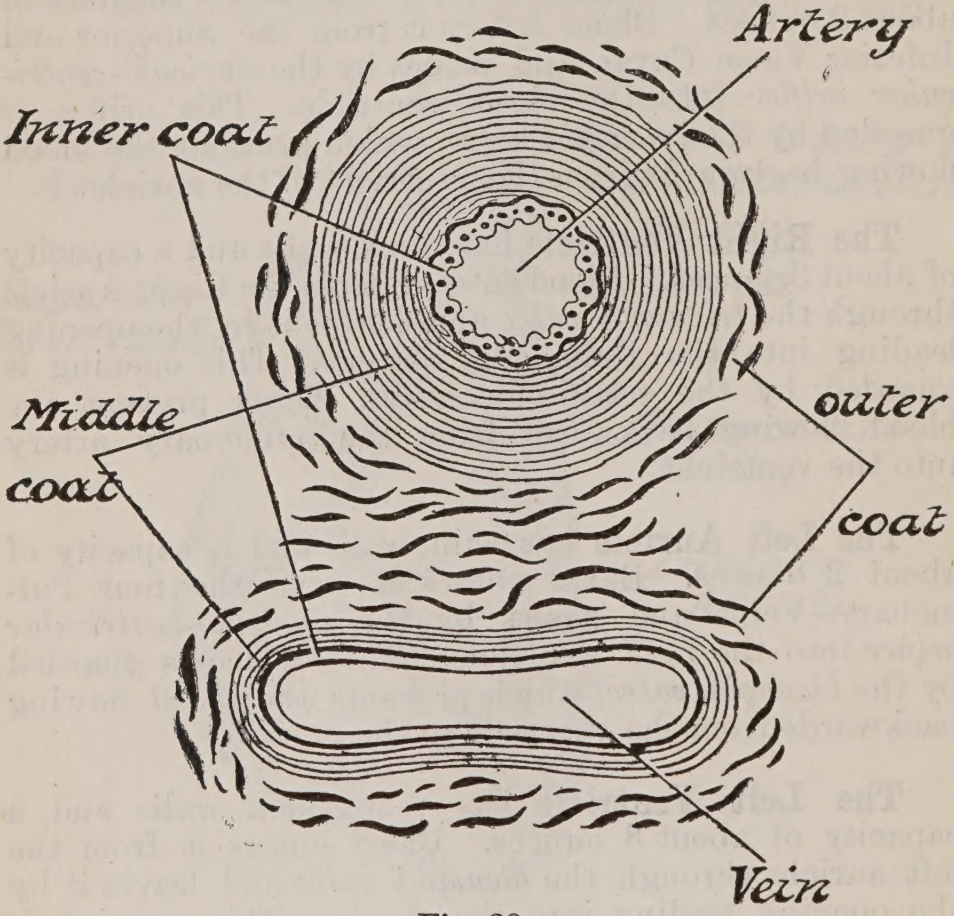


Fig. 38.

Section through an Artery and a Vein.

(*b*) **The Middle Coat** is very thick and composed of elastic and muscular tissues. It is owing to the elastic tissue of this coat that arteries remain open even when empty (like a piece of rubber tubing); and to the muscular tissue that the size of an artery can be altered to regulate the amount of blood flowing through

it. This muscular layer is of the involuntary variety and is controlled by the sympathetic nervous system.

(*c*) **The Inner Coat** is extremely thin and delicate, and consists of flat epithelial cells.

Arteries are not provided with valves, except the Aorta and Pulmonary Artery where they leave the heart. They divide into branches which become smaller by repeated subdivision and finally end in capillaries.

CAPILLARIES form the connecting link between the arteries and the veins. They are minute tubes, only just large enough to allow the blood corpuscles to pass, and are found in practically every part of the body, forming a sort of network. The walls are composed of a single layer of flat epithelial cells, through which gases, serum, and the white corpuscles can pass.

VEINS are the vessels through which blood is carried back to the heart. They commence by the union of several capillaries, and the nearer they get to the heart the larger they become by receiving other veins as tributaries—like a river. Like the arteries, they are composed of three coats—outer, middle and inner. The middle coat, however, is much thinner and so the veins collapse when empty (like a piece of canvas fire-hose).

Most veins are provided with semilunar valves, which are arranged so as to prevent the blood flowing away from the heart. The following veins, however, have no valves:—the venæ cavæ, the portal, pulmonary, cerebral, hepatic and renal veins, and all the very small veins.

THE ARTERIES.

The arteries of the body are arranged like the branches of a tree, the trunk of which comes directly from the heart and is called the Aorta.

The Aorta commences at the left ventricle and, passing upwards, arches over the root of the left lung and then descends within the thorax on the left side of

the vertebral column. It pierces the diaphragm and enters the abdomen, ending opposite the fourth lumbar vertebra. It is, therefore, usually described in three portions, *the ascending aorta*, *the arch of the aorta*, and *the descending aorta*, the last part being subdivided into the *thoracic aorta* and the *abdominal aorta*.

From the arch of the aorta three branches are given off:—the Innominate, the Left Common Carotid, and the Left Subclavian Arteries.

The Innominate Artery is about $1\frac{1}{2}$ inches in length and ends by dividing into the right common carotid and the right subclavian arteries. From this point both sides of the body are alike, so that only one need be described.

The Common Carotid Artery runs up the side of the neck, behind the sterno-mastoid muscle, to the level of the thyroid cartilage, where it divides into the internal and external carotid arteries.

The Internal Carotid Artery runs up the side of the neck, lying very deeply and near the vertebræ, and enters the skull through a canal in the temporal bone. It supplies the brain and the eye.

The External Carotid Artery lies nearer the surface and gives off four important branches:—the facial, lingual, temporal, and occipital arteries.

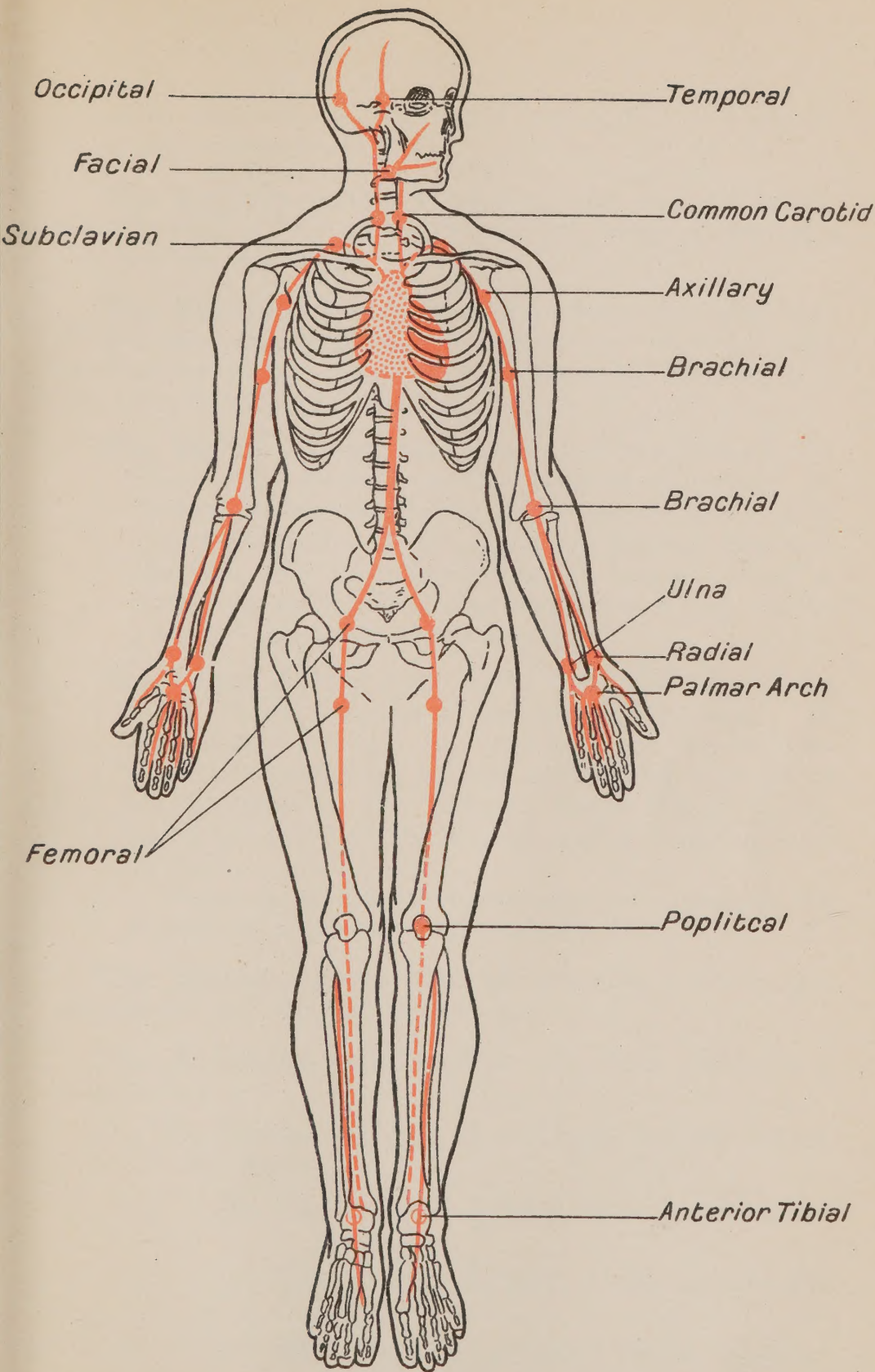
The Facial Artery runs from the neck over the lower jaw to supply the face.

The Lingual Artery lies under, and supplies, the tongue

The Temporal Artery runs upwards in front of the ear to supply the side of the head.

The Occipital Artery runs backwards behind the ear to supply the back of the head.

The Subclavian Artery passes outwards from behind the sterno-clavicular joint to the lower border of the first rib, where it becomes the axillary artery. It gives off branches to the surrounding parts, and one important branch, **the Vertebral Artery**, which runs



ARTERIES OF THE BODY AND COMPRESSION POINTS.

Fig 39.

Malby & Sons, Lith.

upwards and enters the skull through the foramen magnum to supply the brain.

The Axillary Artery runs from the first rib to the lower border of the axilla, or arm pit, where it becomes the brachial artery.

The Brachial Artery continues down the inner side of the arm and then curves to the front where it ends one inch below the bend of the elbow by dividing into two—the radial and ulnar arteries.

The Radial Artery runs down the outer side of the front of the forearm to the front of the wrist. It then winds backwards round the carpus, and finally enters the palm of the hand by passing between the first and second metacarpal bones. Here it forms an arch, called the *deep palmar arch* which gives off branches to the fingers.

The Ulnar Artery runs down the inner side of the front of the forearm to the front of the wrist. It then passes straight into the palm of the hand to form the *superficial palmar arch*, which also gives off branches to the fingers. These branches run along the sides of the fingers and not on the back or front.

There is a direct communication between the superficial and deep palmar arches.

The Thoracic Aorta gives off branches to the lungs, œsophagus and intercostal muscles.

The Abdominal Aorta gives off three important branches :—

(1) **The Cœliac Axis,** a short thick branch which divides into

(*a*) **The Gastric Artery,** which supplies the stomach ;

(*b*) **The Splenic Artery,** which supplies the spleen ;

(*c*) **The Hepatic Artery,** which supplies the liver.

(2) **The Mesenteric Arteries,** two in number, which supply the small and large intestines and the rectum.

(3) **The Renal Arteries,** two in number, which supply the kidneys.

Opposite the fourth lumbar vertebra the abdominal artery divides into the right and left common iliac arteries.

The Common Iliac Arteries, about 2 inches in length, run downwards into the pelvis, gradually separating as they go, and each divides into an internal and external iliac artery.

The Internal Iliac Artery divides into several branches to supply the tissues and organs of the pelvis.

The External Iliac Artery passes downwards and out of the abdomen at the middle of the fold of the groin, where it becomes the femoral artery.

The Femoral Artery commences at the fold of the groin, midway between the anterior superior spine of the ilium and the symphysis pubis. It runs for a short distance down the front of the thigh, and then dips between the femur and the adductor muscles to appear at the back of the knee as the popliteal artery.

The Popliteal Artery passes down the back of the knee and divides into the anterior and posterior tibial arteries.

The Anterior Tibial Artery passes forwards between the tibia and fibula to the front of the leg, and then runs downwards deeply covered by muscles. At the front of the ankle it becomes superficial, and is continued on to the dorsum of the foot as the dorsalis pedis.

The Dorsalis Pedis Artery forms an arch on the back of the foot, from which branches are given off to supply all the toes.

The Posterior Tibial Artery runs down the back of the leg, deeply covered by the calf muscles, to behind the internal malleolus, where it divides into the Internal and External Plantar Arteries.

The Internal and External Plantar Arteries form a loop on the sole of the foot from which branches are given off to supply the toes.

THE VEINS.

The veins of the body are arranged in a much more irregular manner than the arteries, and are divided into two sets—the superficial and the deep veins.

The Superficial Veins are seen just under the skin as bluish cords.

The Deep Veins accompany, and, as a rule, take the same name as, the arteries. Thus the Femoral Vein carries the blood up the thigh and runs alongside the Femoral Artery.

Veins of the Upper Part of the Body.

The veins from each side of the head collect into two vessels, the **Internal** and **External Jugular Veins,** of which the former is much the larger. These join the Subclavian Vein of the same side to form the Innominate Vein.

The veins from the upper extremity run up the limb and finally form one large vessel, the **Subclavian Vein,** which joins the Jugular Veins to form the **Innominate Vein.** Unlike the arteries, there is a Right and Left Innominate Vein. These unite to form the **Superior Vena Cava,** which enters the right auricle. (*See* Fig. 40, page 48.)

Veins of the Lower Part of the Body.

The deep veins from the lower extremity are arranged on the same plan as the arteries. Thus, from the foot upwards, we have the **Anterior** and **Posterior Tibial.** the **Popliteal, Femoral, External Iliac** and **Common Iliac Veins. The Internal Iliac Veins** drain the pelvis. The right and left **Common Iliac Veins** unite to form the **Inferior Vena Cava,** which runs upwards

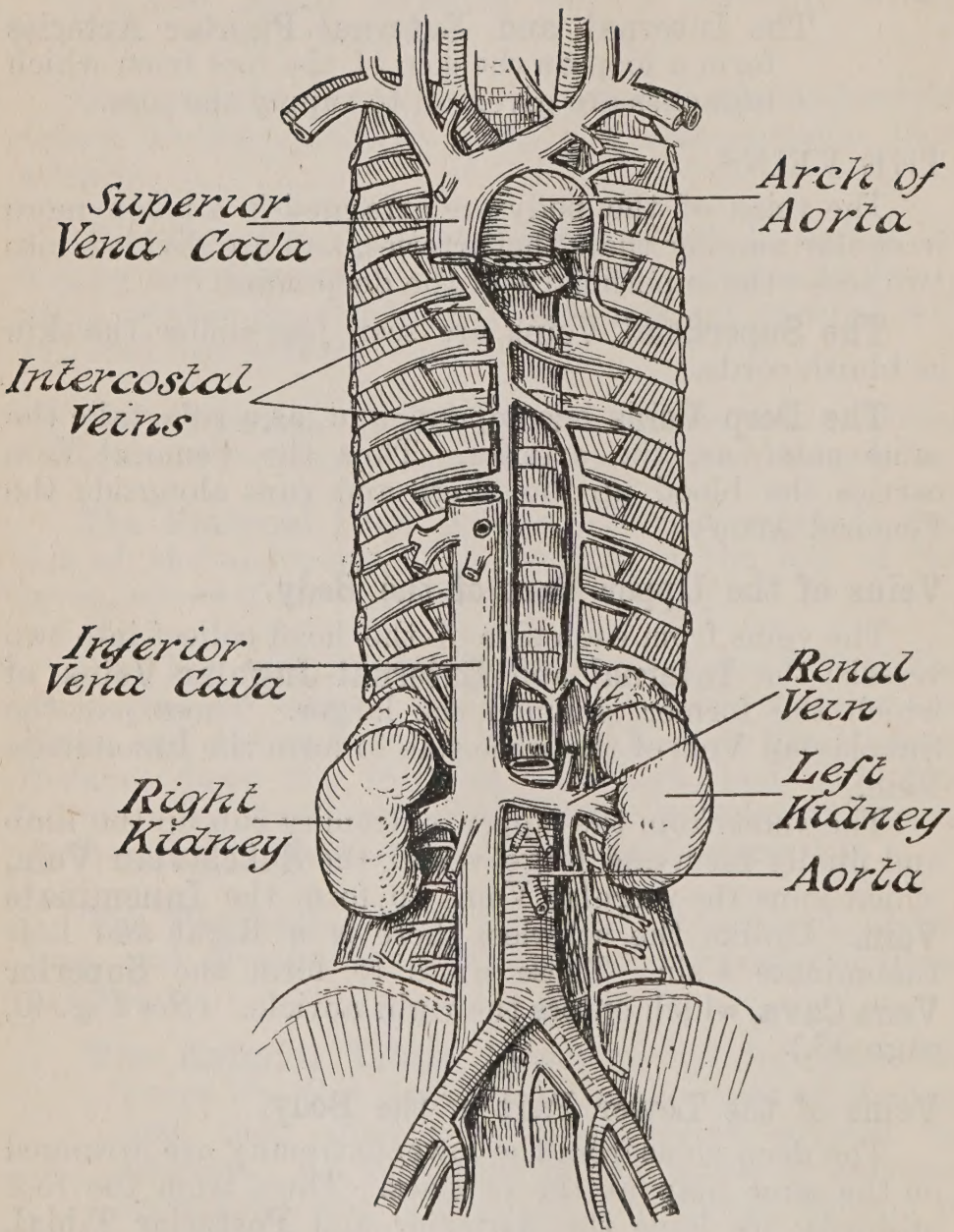


Fig. 40.

Superior and Inferior Venæ Cavæ.

through the abdomen and thorax to the right auricle of the heart. **The Renal** and **Hepatic Veins** run into the Inferior Vena Cava.

The Splenic, Gastric and **Mesenteric Veins** unite to form one large vessel, the **Portal Vein,** which runs across the abdomen to the liver.

THE ORGANS OF RESPIRATION.

These include the nose, the pharynx, the larynx, the trachea and the lungs.

THE NOSE.

The upper part of the nose is composed of bone and the lower part of cartilage. It is divided by a longitudinal septum into the right and left nostrils, which open in front by the *anterior nares*, and end in the Pharynx behind by the *posterior nares*. The interior of the nostrils is thrown into curved ridges by the turbinated bones so as to increase the surface. They are lined by a very vascular mucous membrane which warms and moistens the air as it passes, and also contains the nerve of smell. (*See* Fig. 41, page 50.)

THE PHARYNX is the cavity at the back of the mouth. It is about 4 inches in length and has seven openings communicating with it, viz.:—

The two posterior nares, communicating with the nose.
The two Eustachian tubes, communicating with the ears.
The mouth.
The œsophagus.
The larynx.

THE LARYNX is the organ of voice, and from it opens the trachea. It is composed of cartilages, the chief of which are the Thyroid and Cricoid Cartilages.

The Thyroid Cartilage forms the prominence in the front of the neck known as Adam's apple; **the Cricoid Cartilage** lies just below and is much less prominent.

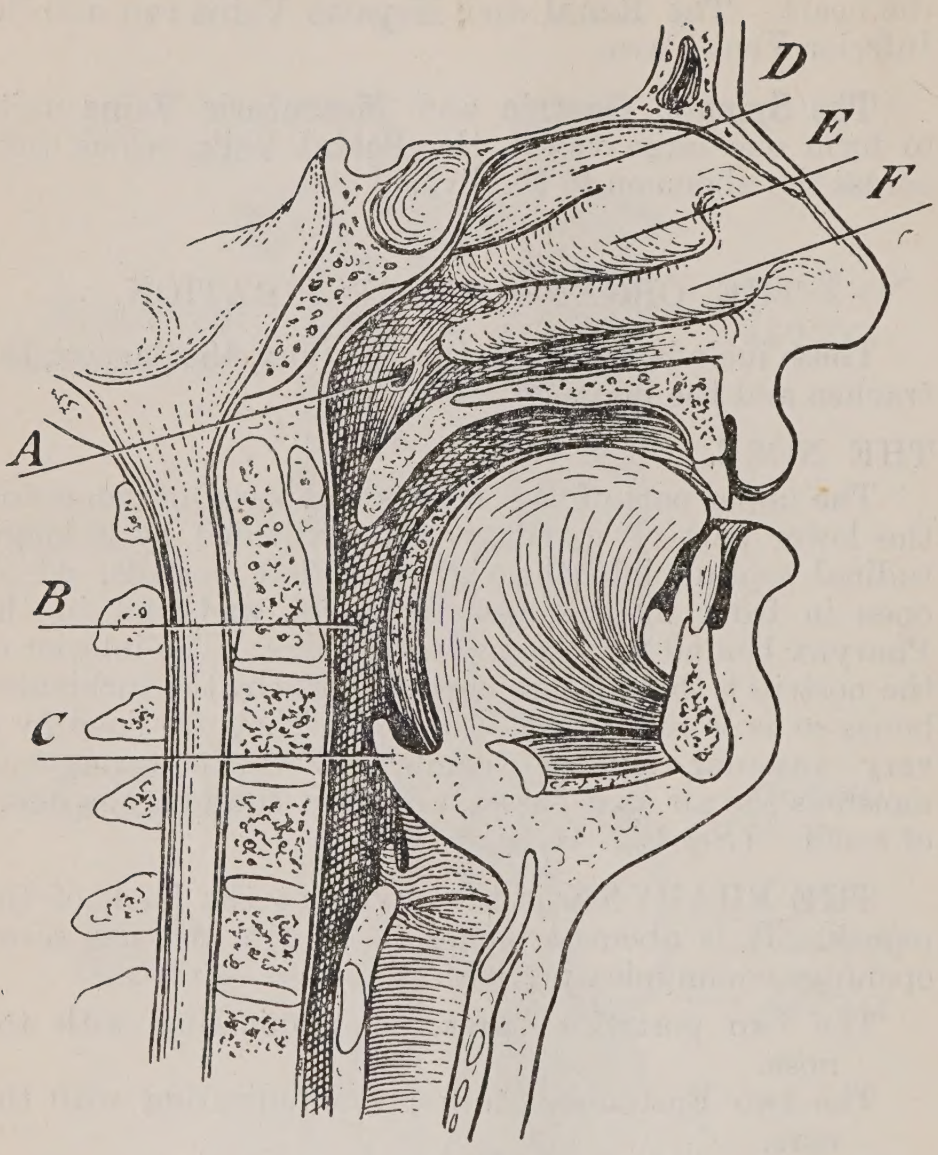


Fig. 41.

Section through the Nose, Mouth, Pharynx, &c.

A.—Eustachian Tube. B.—Pharynx. C.—Epiglottis.

D.
E. } Turbinated Bones.
F.

The upper opening of the Larynx is guarded by a leaf-shaped piece of flexible cartilage, called the *Epiglottis*, which lies behind the tongue and is attached to the front of the Thyroid Cartilage. During respiration the Epiglottis remains upright; but in the act of swallowing it falls backwards, completely covering the opening and so preventing food from passing into the larynx. Inside the Larynx are two fibrous bands, called the *Vocal Chords*, the vibration of which produces the voice.

THE TRACHEA is a cartilaginous and membranous tube, about 4 inches in length and 1 inch in diameter, which extends from the lower part of the Larynx to opposite the fourth dorsal vertebra, where it divides into the two Bronchi, one for each lung. It is composed of C-shaped rings of cartilage, 15 to 20 in number, embedded in a fibrous and muscular membrane. The cartilages surround the front and sides of the Trachea, but at the back, where it is in contact with the Œsophagus, the tube is composed of membrane only.

The Trachea is lined with mucous membrane.

THE BRONCHI, right and left, are formed by the division of the Trachea. After entering the lungs they divide and subdivide into innumerable branches, which gradually become smaller in diameter, and finally end in closed sacs called the *Infundibula*. The walls of each Infundibulum are not smooth, but form little pouches called *Alveoli* or air-cells. The walls of the Alveoli are composed of a thin layer of connective tissue through which gases can pass.

THE LUNGS are two spongy elastic organs, situated in the thorax, and separated by the heart. They are greyish in colour, and together weigh about 42 ounces. They are conical in shape, the apex being above and the base below, resting on the diaphragm. They are divided by deep fissures into *lobes*, of which the right lung has three and the left two. The points where the bronchi and blood vessels enter are called the *roots* of the lungs.

The lungs are composed of alveoli and of the branches of the bronchi and the pulmonary blood vessels, held together by connective tissue. Healthy lung tissue floats in water.

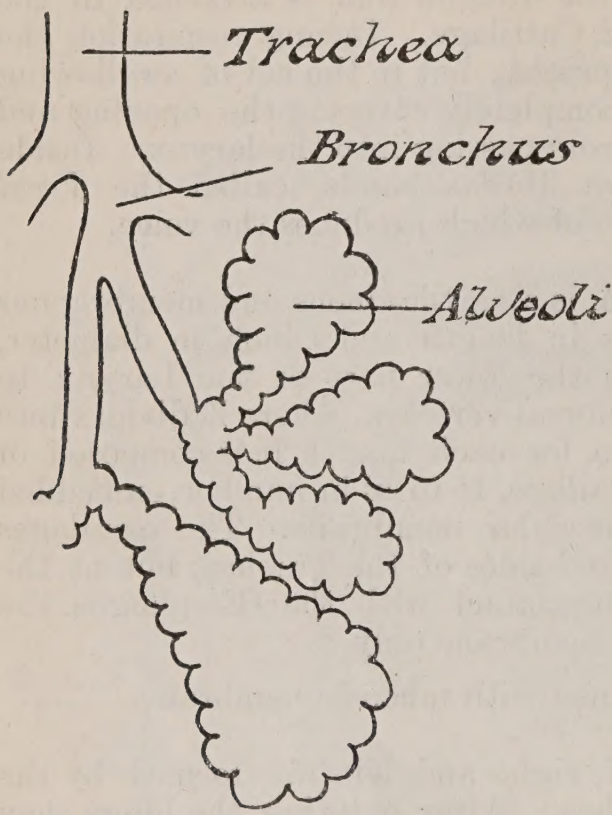


Fig. 42.
Diagram of the Alveoli of the Lungs.

The branches of the pulmonary arteries end in capillaries which surround the walls of the alveoli. Between the blood and the air there are thus only two very thin layers of tissue, through which gases can pass; and it is here that the actual interchange of gases, constituting respiration, takes place.

THE PLEURA.

Each lung is enclosed in a delicate membrane called the pleura. At the root of each lung the pleura is reflected on to the inner surface of the thorax, which it lines. There are thus two layers of pleura in the chest, and the adjacent surfaces are moistened with serum to prevent friction. In health there is no actual space between these layers.

THE ORGANS OF DIGESTION.

The organs of digestion are the alimentary canal and certain accessory organs.

The Alimentary Canal includes—

The mouth.
The pharynx.
The œsophagus.
The stomach.
The small intestine.
The large intestine.

The Accessory Organs are—

The teeth.
The tongue.
The salivary glands.
The liver.
The pancreas.

THE MOUTH is bounded in front by the lips, at the sides by the cheeks, above by the palate and behind by the soft palate and fauces, while the floor is composed of muscles and mucous membrane, which also lines the whole of the cavity.

The Palate, or roof of the mouth, consists of two portions—the hard and the soft palate. The hard palate is in front, and is formed by the superior maxillæ and the palate bones; the soft palate is behind, and consists of muscular tissue covered with mucous membrane. Hanging from its free border is a long conical process called the *Uvula*, at each side of which are two folds of mucous membrane, called the *Pillars of the Fauces*, between which lie the *Tonsils*.

THE TONGUE is a muscular organ attached behind to the hyoid bone and the pharynx, and to the floor of the mouth by a thin membranous band called the *Frænum*. It is the organ of taste, and also serves to mix the food and force it between the teeth.

THE TEETH, in the adult, are 32 in number, 16 in each jaw, and are of four kinds.

There are:—

8 incisor teeth,
4 canine ,,
8 bicuspid ,,
12 molar ,,

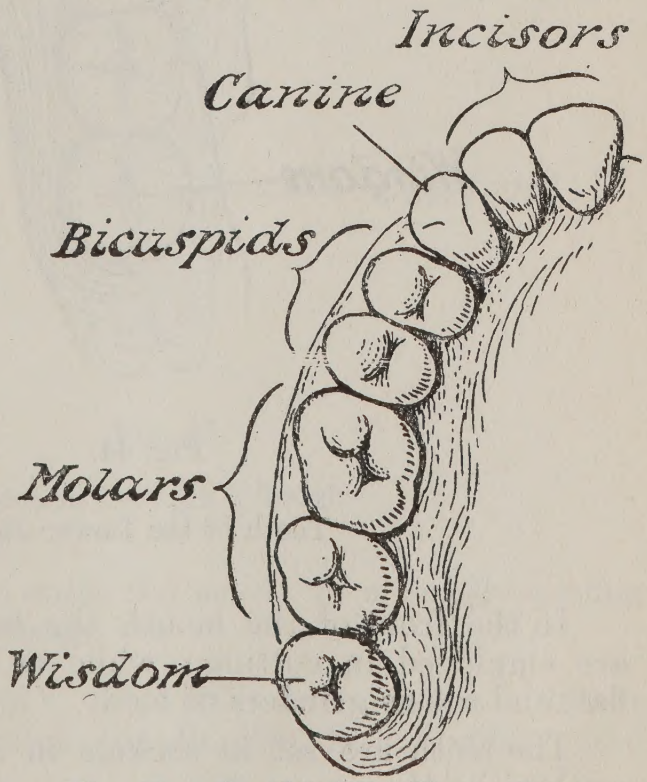


Fig. 43.—Teeth of the Upper Jaw.

which are arranged in the following order in each jaw:—

M M M B B C I I I I C B B M M M.

The last molars are called the *wisdom teeth*, because they do not appear until from the 17th to 25th year of life.

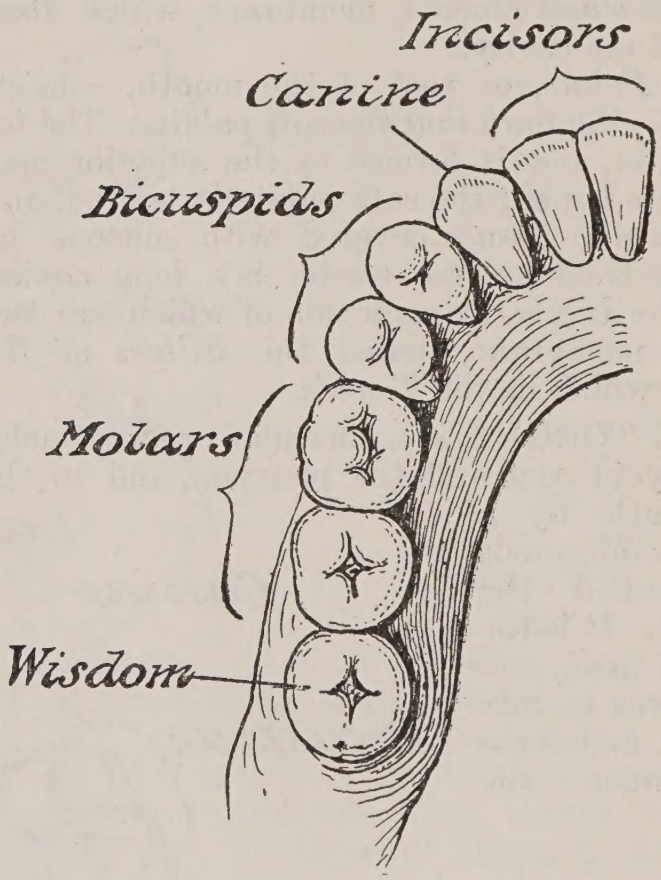


Fig. 44.

Teeth of the Lower Jaw.

In the front of the mouth the teeth are sharp, and are employed in cutting; while at the back they are flat, and act as grinders of food.

The teeth are set in sockets in the jaws, which are covered by the gums.

Each tooth has a crown, a neck, and one or more fangs, and is composed of *dentine* covered by a thin layer of *enamel*. The centre of the tooth is hollow, and contains the *pulp*, which is supplied with blood vessels

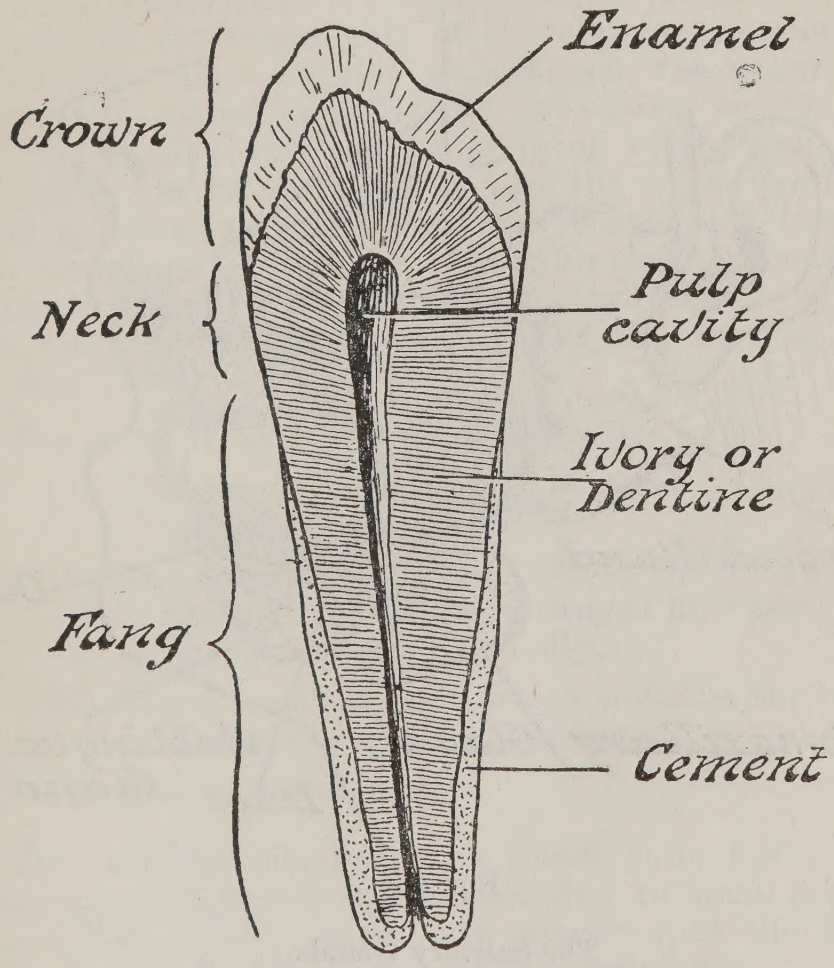


Fig. 45.

Section through a Tooth.

and nerves. These enter the cavity by a small opening at the end of each fang.

THE SALIVARY GLANDS secrete saliva. There are three pairs, called the Parotid, Submaxillary, and Sublingual Glands.

The Parotid Glands surround the lower part of the ears. Each gland has one duct which opens on the inner side of the cheek opposite the second upper molar tooth.

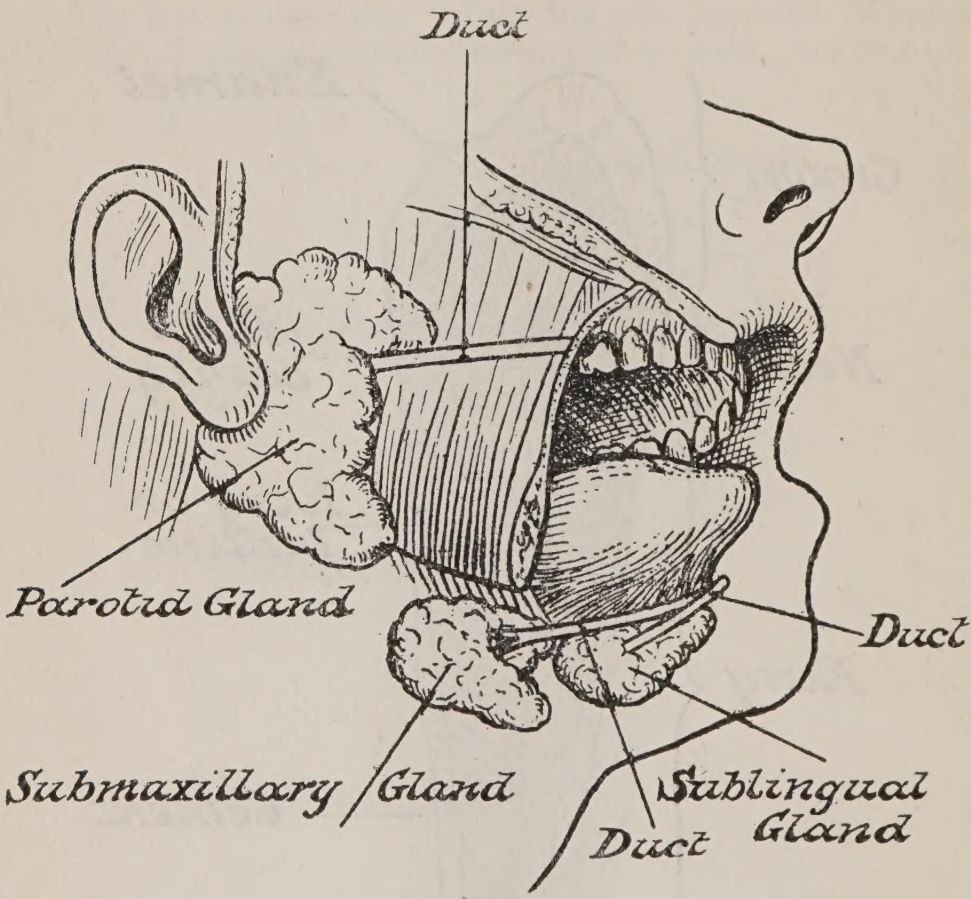


Fig. 46.

The Salivary Glands.

The Submaxillary Glands lie under the lower jaw. Each gland has one duct which opens on the floor of the mouth at the side of the frænum of the tongue.

The Sublingual Glands lie under the tongue. Each gland has about 20 small ducts which open on to the floor of the mouth.

THE PHARYNX has already been described.

THE ŒSOPHAGUS, or gullet, is a muscular tube, about 9 inches in length, which connects the pharynx with the stomach, passing through an opening in the diaphragm. It is lined by mucous membrane.

THE STOMACH is a hollow organ situated at the left side of the upper part of the abdomen, under the diaphragm. It is roughly pear-shaped, the upper and larger end—called the *Cardiac end*—being to the left, and the smaller, or *Pyloric*, end being to the right. It is slightly curved on itself, so that the upper border is short and concave, while the lower is long and convex. The œsophagus opens on the upper surface near the cardiac end. Food leaves the stomach at the pyloric end, passing through a valve, called the *Pylorus*, into the small intestine.

The stomach wall consists of four coats :—

(1) The serous or outer coat, formed by the peritoneum.

(2) The muscular coat, in which the involuntary muscular fibres are arranged longitudinally, circularly, and diagonally.

(3) The submucous coat, which contains the blood vessels, nerves and lymphatics.

(4) Mucous membrane.

The mucous membrane is raised into folds, and presents a honeycomb appearance due to small depressions called *Alveoli*. Into these alveoli open the ducts of the *Peptic Glands* which secrete gastric juice.

THE SMALL INTESTINE is a tube about 21 feet in length, which lies coiled up irregularly in the abdominal cavity. It is divided into three parts :—

(1) **The Duodenum** is the first part, and is about 10 inches in length. After leaving the stomach it curves to the left round the head of the pancreas. Into it opens the common bile duct.

(2) **The Jejunum** is the next part, and measures about 8 feet in length.

(3) **The Ileum** is the last part, measures about 12 feet in length, and joins the large intestine at the ileo-cæcal valve.

The duodenum is firmly fixed to the back of the abdomen, but the jejunum and ileum are loosely suspended by a membrane called the *mesentery*.

THE LARGE INTESTINE is very much wider than the small, but is only about 6 feet in length. It runs from the ileum to the anus, and is divided into three parts :—

(1) **The Cæcum** is a large pouch about 3 inches in diameter, lying in the right lower angle of the abdomen. Into it opens the ileum through the *ileo-cæcal valve*. Attached to the cæcum, and opening into it, is a narrow worm-like tube called the **Vermiform Appendix.**

(2) **The Colon** runs from the cæcum up the right side of the abdomen, across the upper part and down the left side to the rectum. Consequently it is said to consist of three parts :— the ascending, transverse and descending colon.

(3) **The Rectum** is the last part of the large intestine. It is from 6 to 8 inches in length and lies in the middle line of the body. Its lower end opens on to the surface by the **Anus.**

The whole of the large intestine is fixed to the posterior abdominal wall and always retains the same position.

Both the small and the large intestines consist of four coats, like the stomach :—

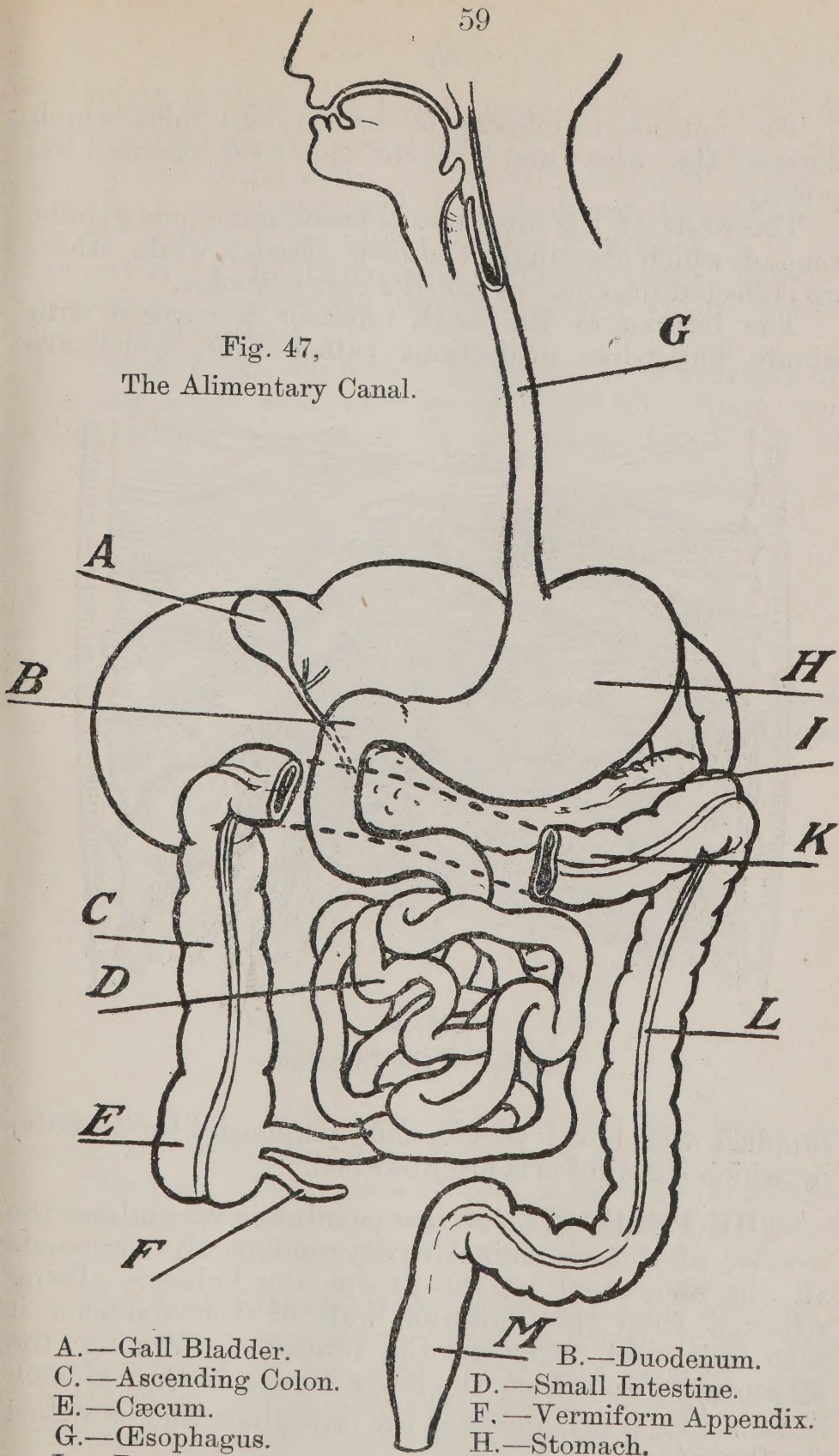
(1) Serous.

(2) Muscular.

(3) Submucous.

(4) Mucous.

Fig. 47,
The Alimentary Canal.



A.—Gall Bladder.
B.—Duodenum.
C.—Ascending Colon.
D.—Small Intestine.
E.—Cæcum.
F.—Vermiform Appendix.
G.—Œsophagus.
H.—Stomach.
I.—Pancreas.
K.—Transverse Colon.
L.—Descending Colon.
M.—Rectum.

The mucous membrane is thrown into folds which increase the area and prevent the food passing too quickly.

The walls of the intestines contain numerous glands, some of which are single (*solitary glands*), while others are collected into masses called *Peyer's patches.*

The interior of the small intestine is covered with minute finger-like projections called *Villi*, which are

Fig. 48.
Interior of the Intestine.

supplied with blood vessels and lymphatics (or *lacteals*) by which certain foods are absorbed.

THE PERITONEUM is a membrane which lines the interior of the abdominal cavity and partly surrounds all the abdominal organs except the kidneys. Being reflected from the posterior wall of the abdomen it surrounds and supports the intestines, forming the **Mesentery**; and from the lower border of the stomach it falls like a curtain over the intestines and is called the **Omentum.**

THE LIVER is a large glandular organ which lies on the right side of the upper part of the abdomen, just under the diaphragm. It measures about 10 inches in length, 6 in breadth and 3 in thickness, and weighs 50 or 60 ounces. The upper surface is arched to fit the concavity of the diaphragm, while the lower surface is flattened. It is divided into two lobes, of which the right is much the larger.

Blood enters the liver both by the hepatic artery and by the portal vein, and leaves it by the hepatic vein. Bile, which is secreted by the liver, leaves by the

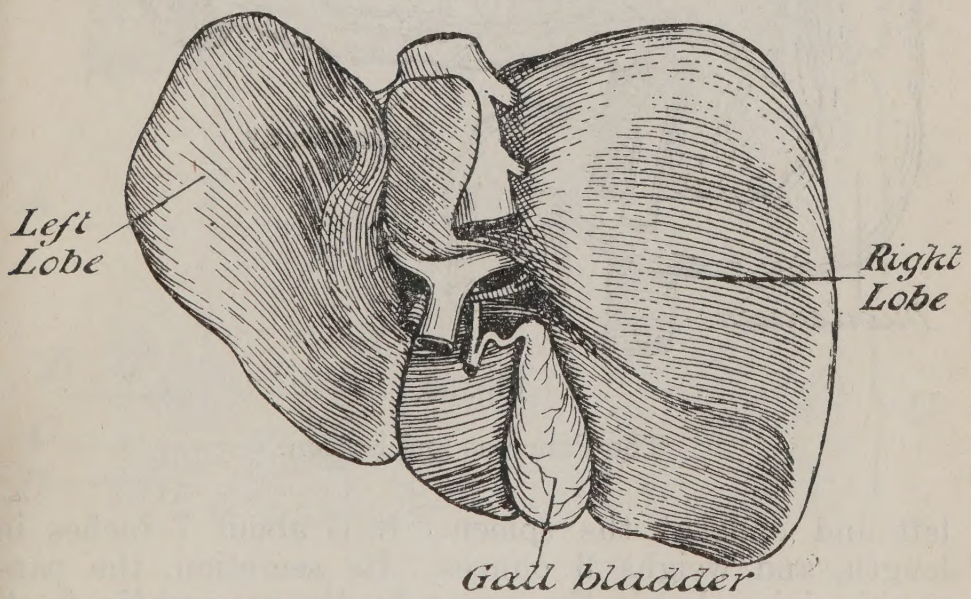


Fig. 49.
The Liver (under surface).

hepatic duct. All these vessels enter and leave the organ on its under surface, between the lobes.

The liver is composed of cells, collected into lobules, which can be distinctly seen with the naked eye. These lobules are bound together by connective tissue.

The Gall Bladder is the reservoir for the bile. It is a pear-shaped bag about 4 inches in length, lying on the under surface of the liver. The bile escapes by the **cystic duct,** which joins the hepatic duct to form the **common bile duct** which enters the duodenum.

THE PANCREAS, or sweetbread, is a large gland which lies transversely behind the stomach. It has a rounded head which fits into the concavity of the duodenum, a body, and a tapering tail which runs to the

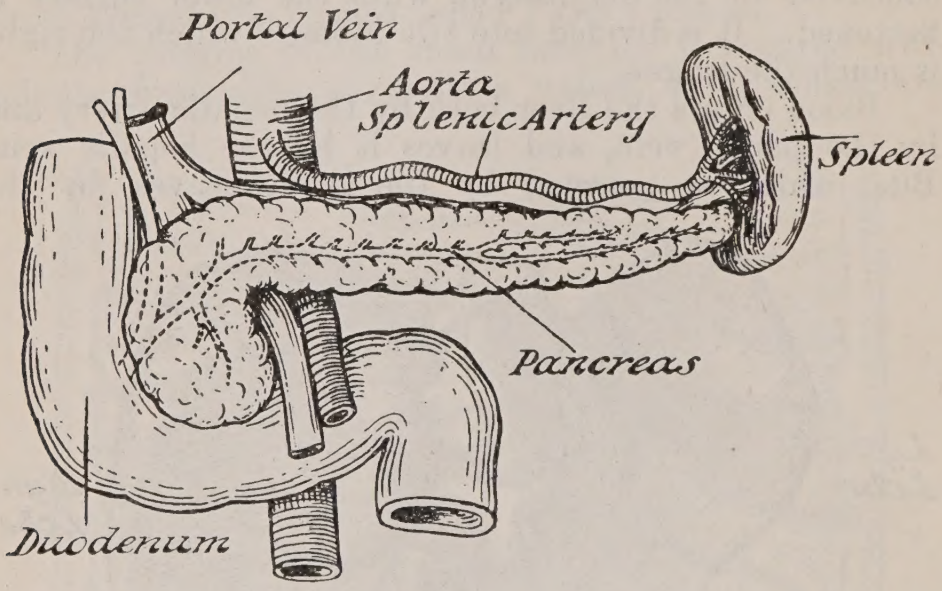


Fig. 50.

The Pancreas and Spleen.

left and ends at the spleen. It is about 7 inches in length, and weighs 3 ounces. Its secretion, the pancreatic juice, leaves the organ by the **pancreatic duct,** which enters the duodenum with the common bile duct.

THE ORGANS OF EXCRETION.

THE SKIN.

The Skin consists of two layers, the Epidermis or scarf skin, and the Dermis or true skin.

The Epidermis consists of a horny layer of flat cells covering a softer layer of round cells. The thickness varies considerably, the thickest parts being those exposed to pressure, such as the palms of the hands and the soles of the feet. The surface is marked out into

small areas by depressed lines, easily seen on the back of the hand; and is perforated by small holes, commonly called the *pores*, which are the openings of the ducts from the sweat glands. Hairs project from its surface.

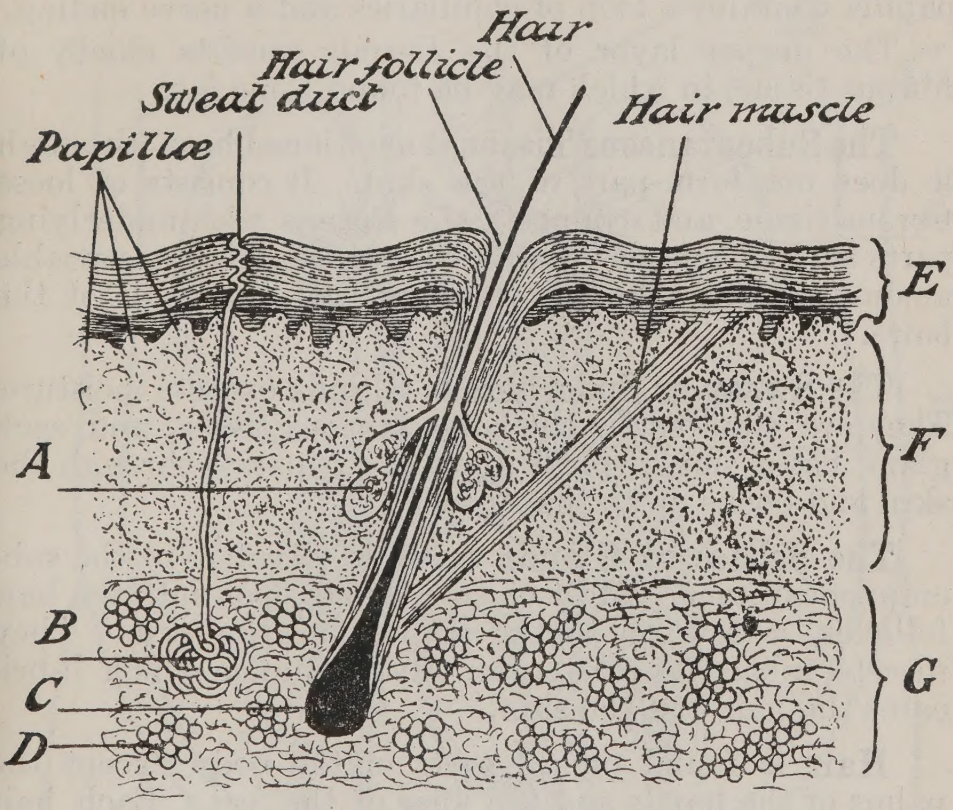


Fig. 51.

Section through the Skin.

A.—Sebaceous Gland. B.—Sweat Gland.
C.—Root of Hair. D.—Fat. E.—Epidermis.
F.—Dermis. G.—Subcutaneous Tissue.

The cells of the horny layer are being constantly rubbed off, and their place is taken by new cells which form below.

The Epidermis contains no blood-vessels and only very few nerves. Its use is to protect the sensitive Dermis under it.

The Dermis is tough and elastic, and consists of two layers. The outer layer, lying directly under the Epidermis, has minute eminences called *Papillæ*, which are very sensitive and form the organ of touch. Each papilla contains a loop of capillaries and a nerve ending.

The deeper layer of the Dermis consists chiefly of fibrous tissue, in which may be found some fat.

The Subcutaneous Tissue is mentioned here, although it does not form part of the skin. It consists of loose fibrous tissue, and connects the Dermis with underlying parts such as muscles and bone. It contains a variable amount of fat, the sweat glands, and the roots of the hairs.

The Sweat, or Sudoriferous Glands excrete moisture. They are situated in the subcutaneous tissue, and each gland has a single spiral duct, which passes through the skin and opens on to the surface.

The Sebaceous Glands are also situated in the subcutaneous tissue. Most of their ducts open into the hair follicles, a few on to the surface of the skin. They secrete sebaceous matter, an oily substance which lubricates the hair and the skin.

Hair is found on all parts of the body except the palms of the hands and the soles of the feet. Each hair consists of a root and a stem, and is embedded in a deep recess of the subcutaneous tissue called the *hair follicle*. The root is in the form of a bulb, and constitutes the growing part of the hair. The stem is not supplied with blood-vessels or nerves.

The hair follicle lies at an angle to the surface of the skin, so that the contained hair lies more or less flat. To each follicle is attached a small involuntary muscle which, by contracting, causes the hair to stand more upright.

Each hair is composed of a fibrous bark surrounding a central pith.

The Nails are practically hard and thick epidermis. They are attached to the dermis in the bed of the nail, or quick, and at the root.

THE URINARY ORGANS.

The urinary organs consist of the kidneys, ureters, bladder and urethra.

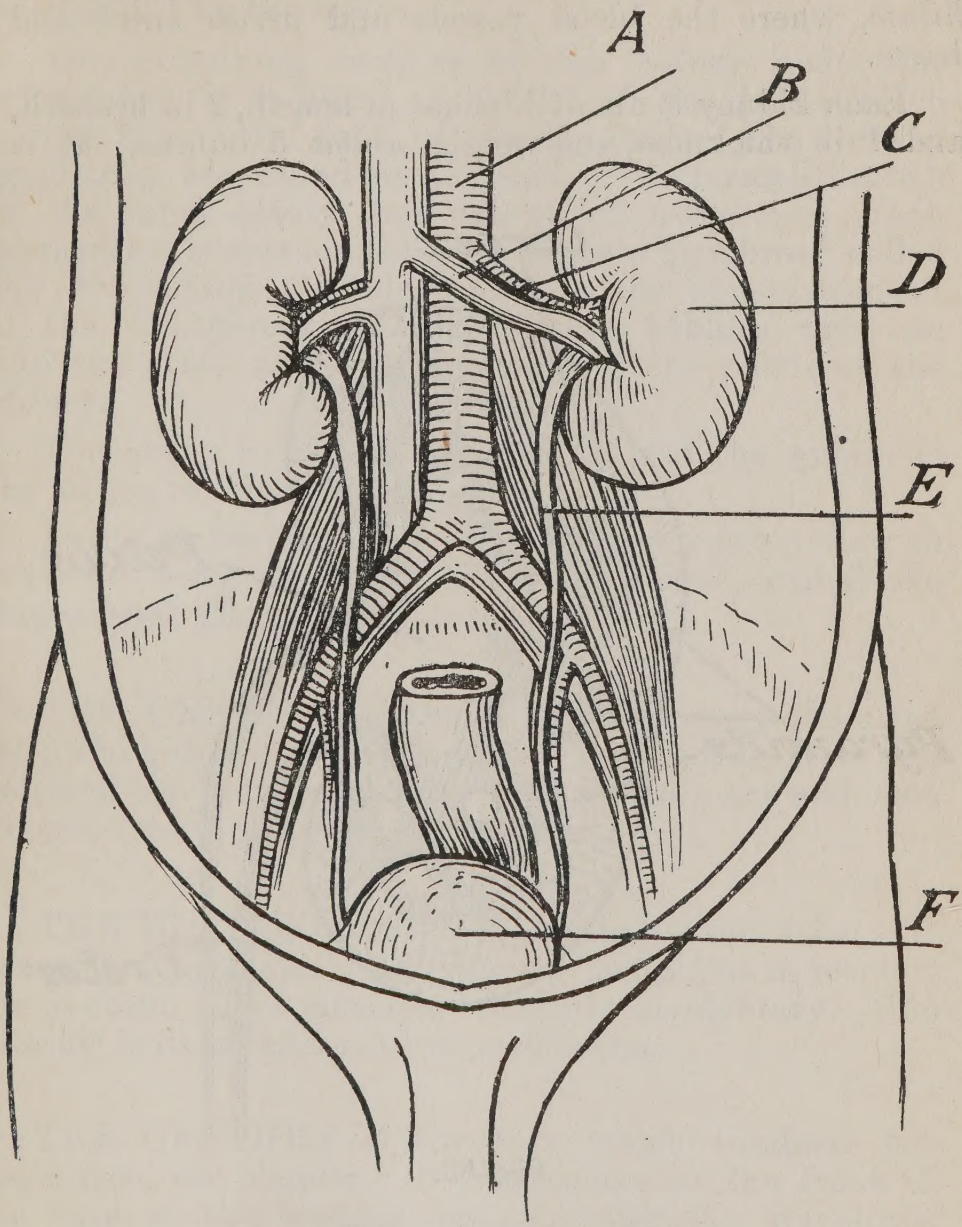


Fig. 52.
The Urinary Organs.
A.—Aorta. B.—Renal Vein. C.—Renal Artery.
D.—Kidney. E.—Ureter. F.—Bladder.

THE KIDNEYS, two in number, are situated at the back of the abdomen, one on either side of the vertebral column, on a level with the first three lumbar vertebræ.

Their shape is characteristic. The outer border is convex; while the inner—towards the vertebral column—is concave, and presents a deep fissure, called the *hilum*, where the blood vessels and ureter enter and leave.

Each kidney is about 4 inches in length, 2 in breadth, and 1 in thickness, and weighs about 5 ounces. It is

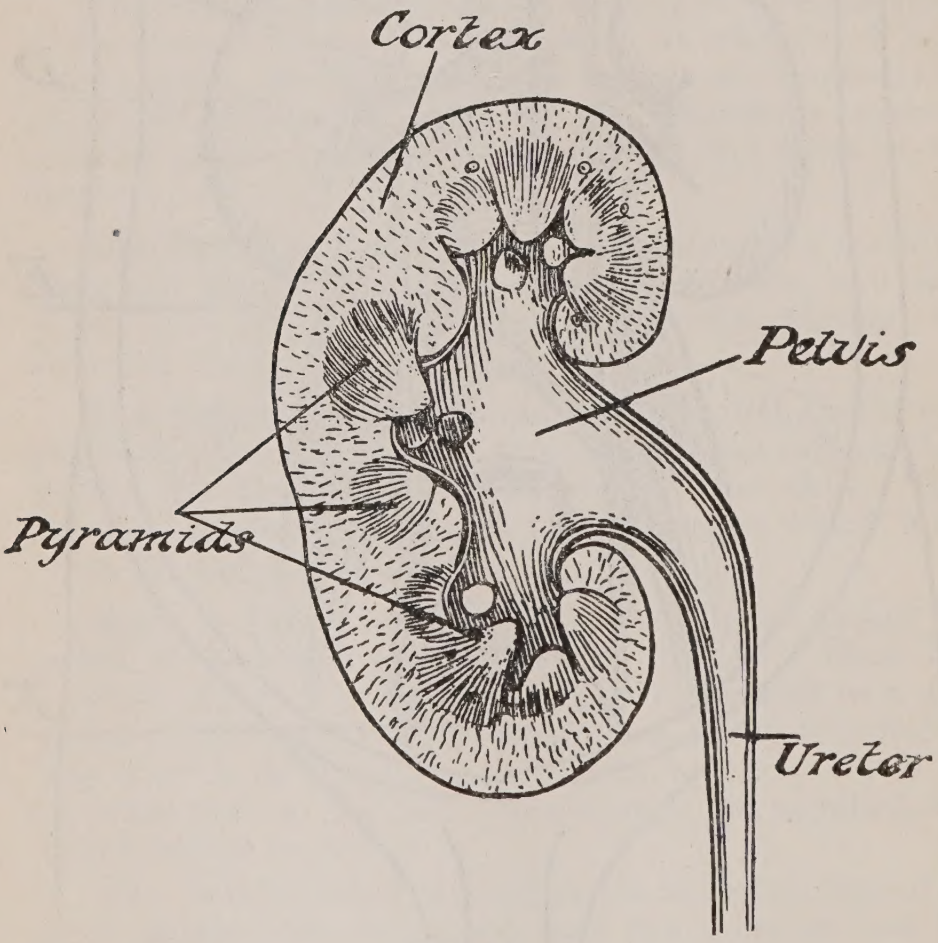


Fig. 53.

Section through a Kidney.

surrounded by a strong fibrous *capsule*, on removing which the surface is seen to be smooth and reddish-brown in colour.

To study its structure the kidney must be cut longitudinally from the convex to the concave border. In

the centre is a cavity called the *pelvis*, from which springs the ureter. Projecting into this cavity are the apices of several dark-coloured *pyramids* which are surrounded by the *cortex*.

On examining sections of the kidney under the microscope, it is found to consist of fine tubes which spring from little tufts of blood vessels. The tufts of capillaries are found at the end of each small branch of the renal artery and are called *Glomeruli*. Each glomerulus is surrounded by a delicate membrane called the *Malpighian Capsule*, which is the commencement of the *Uriniferous Tubule*. These tubules run one into the other and finally open into the pelvis of the kidney.

The cortex contains the glomeruli, and the pyramids the larger tubules.

Lying on the upper end of each kidney is a yellowish flattened body, about $1\frac{1}{2}$ inches in length, called the **Suprarenal Gland.**

THE URETERS are the tubes which carry the urine from the kidneys to the bladder. They spring from the pelvis of the kidneys and run downwards in the abdomen to open into the base of the bladder.

THE BLADDER is the reservoir for the urine. It is a hollow muscular bag lying in the pelvis in front of the rectum. The muscular tissue is involuntary. The interior is lined with mucous membrane.

THE URETHRA is the tube which conducts the urine from the bladder. It commences at the front of the base of the bladder, passes under the symphysis pubis, and ends at the *meatus*, at the end of the penis. It is lined with mucous membrane. (*See* Fig. 54, page 68.)

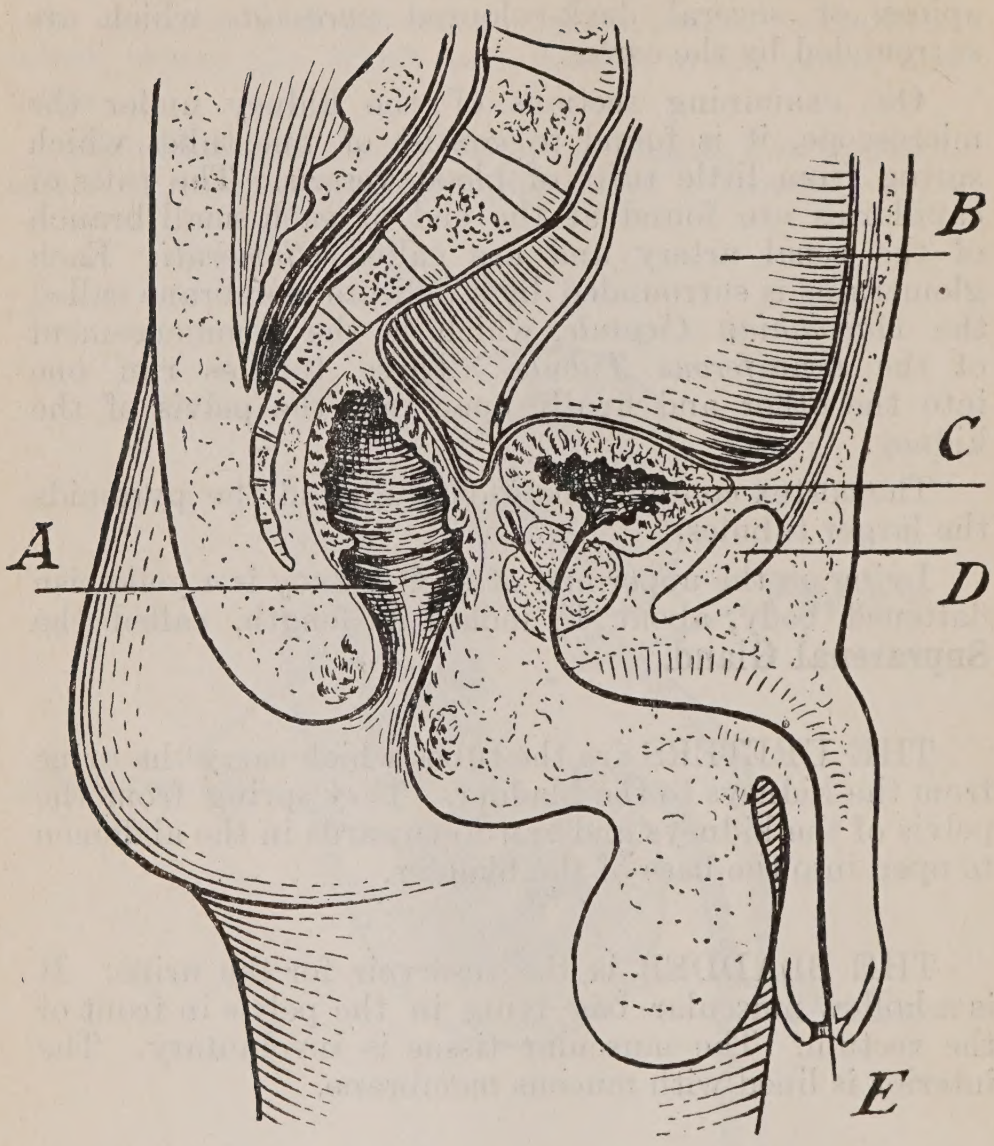


Fig. 54.

Section through the Male Pelvis.

A.—Rectum. B.—Abdominal Cavity. C.—Bladder.
D.—Pubis. E.—Meatus.

THE NERVOUS SYSTEM.

The Nervous System is composed of masses of nervous tissue and of nerves, and is divided into two main groups, the cerebro-spinal nervous system and the sympathetic nervous system.

I.—THE CEREBRO-SPINAL NERVOUS SYSTEM consists of the brain, the medulla oblongata, the spinal cord and the nerves.

The brain occupies the cavity of the skull and is enclosed in three membranes—the dura mater, the arachnoid, and the pia mater.

(*a*) **The Dura Mater** is a strong fibrous membrane which lines the inside of the skull and spinal canal. Its outer surface is rough and is attached to the bones of the skull; the inner surface is smooth. It contains numerous large arteries and veins.

From the portion of this membrane which lines the skull two processes are given off; one runs from before backwards and dips vertically into the fissure between the two hemispheres of the brain, the other forms a covering for the cerebellum and separates it from the cerebrum.

(*b*) **The Arachnoid** is an extremely delicate membrane which lies under the dura mater. It is well supplied with blood vessels. Between the arachnoid and the pia mater is a space, most marked at the base of the brain, called the **sub-arachnoid space.** In this space is a collection of **cerebro-spinal fluid** which acts as a water-cushion for the brain and diminishes shocks.

(*c*) **The Pia Mater** consists of a network of blood vessels covering the surface of the brain. Unlike the other membranes, it dips down between the convolutions and sends blood vessels into the brain substance.

In surgery and medicine these three membranes are usually considered as one, and are then called the **Meninges.**

THE BRAIN consists of the cerebrum, the cerebellum, the pons Varolii, and the medulla oblongata.

1. THE CEREBRUM, or large brain, occupies almost the whole of the cavity of the skull. It is

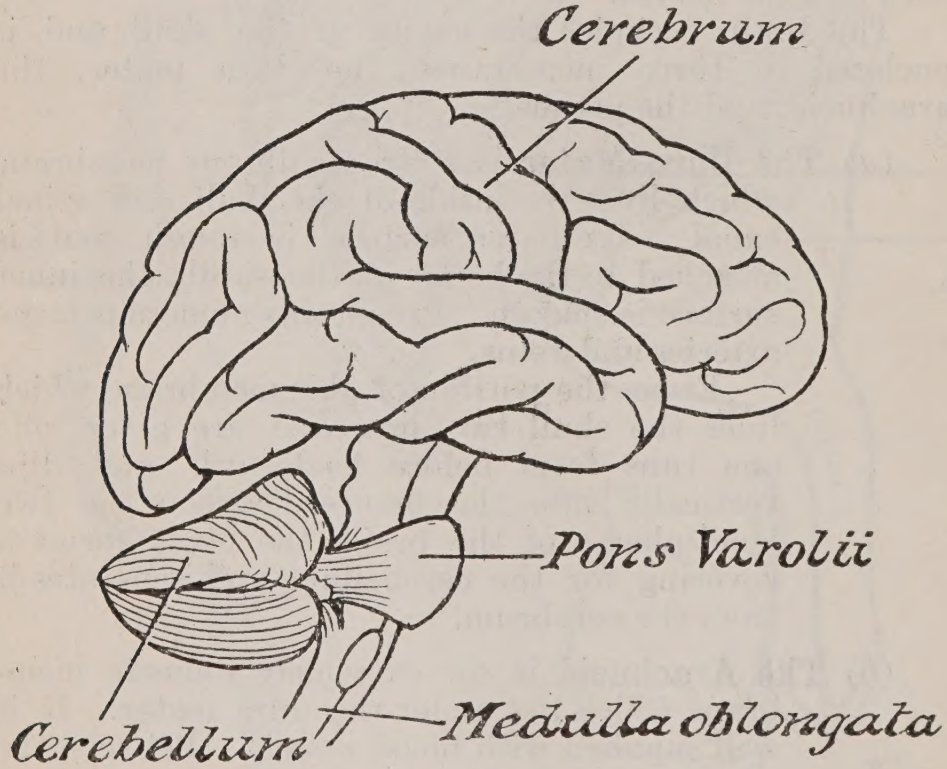


Fig. 55.

The Brain (side view).

divided almost completely into two halves, called the right and left *hemispheres*, by a deep fissure running from the front to the back. The surface is thrown into a number of folds called *convolutions*, whereby the surface area is much increased. The interior of the

cerebrum is not solid throughout, but contains certain cavities called the *ventricles.*

On cutting a section through the brain, it will be seen to consist of two distinct tissues, called on account of their colour, *grey* and *white matter.* The grey matter, which is

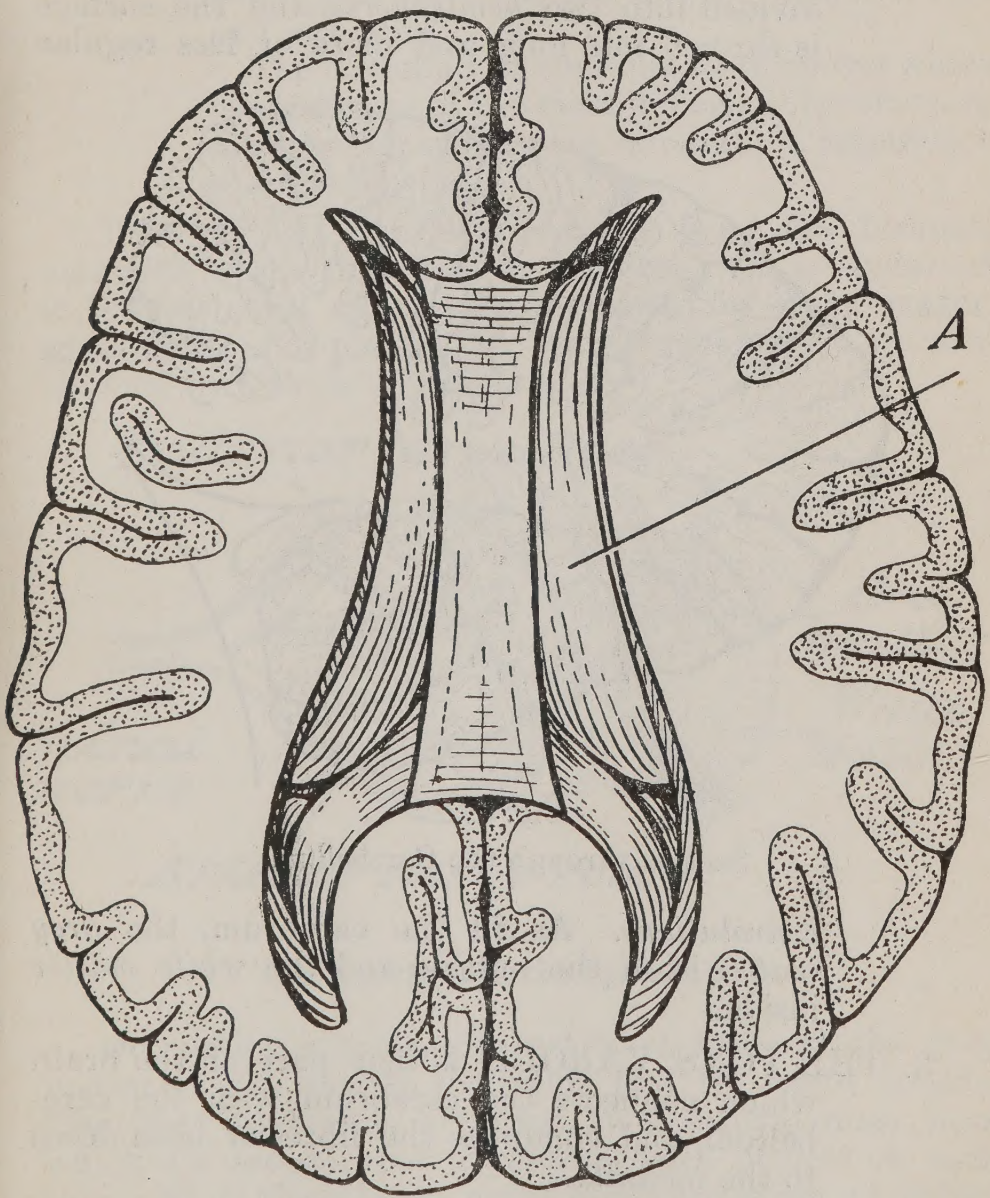


Fig. 56.

Section through the Cerebrum.

A.—Ventricle.

composed of nerve cells, lies on the outside of the brain and encloses the white matter, which is composed of nerve fibres. The white matter is much more abundant than the grey.

2. THE CEREBELLUM, or small brain, lies at the back of the skull, below the cerebrum. It is divided into two *hemispheres*, and the surface is thrown into long and more or less regular

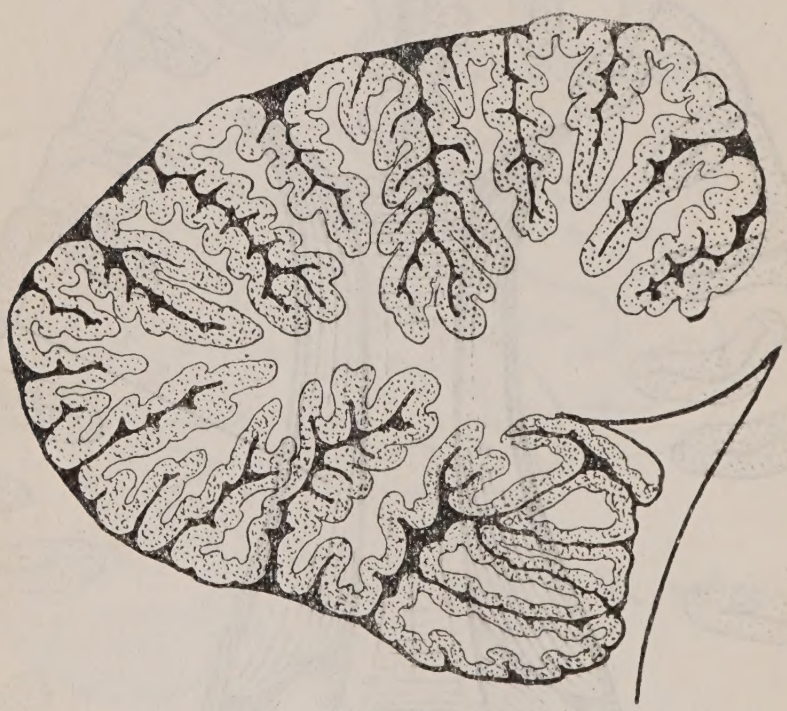


Fig. 57.
Section through the Cerebellum.

convolutions. As in the cerebrum, the *grey matter* is on the outside and the *white matter* inside.

3. THE PONS VAROLII is that part of the brain which connects the cerebrum with the cerebellum, and conducts the fibres of both down to the medulla.

4. THE MEDULLA OBLONGATA, or bulb, runs from the pons Varolii to the lower margin of the foramen magnum, where it is continuous

with the spinal cord. It is composed of *grey* and *white matter*, but, unlike the arrangement in the cerebrum, the grey matter is inside and the white outside.

In the medulla, the nerve fibres cross so that those which come from the right side of the brain pass down the left side of the spinal cord and *vice versâ*.

The medulla also contains *nerve centres* which control some of the most important involuntary movements, such as the circulation, respiration and swallowing.

THE SPINAL CORD extends from the foramen magnum to the first lumbar vertebra. It is contained in the vertebral canal and is covered by **dura mater, arachnoid,** and **pia mater,** which membranes are continuous with those of the skull.

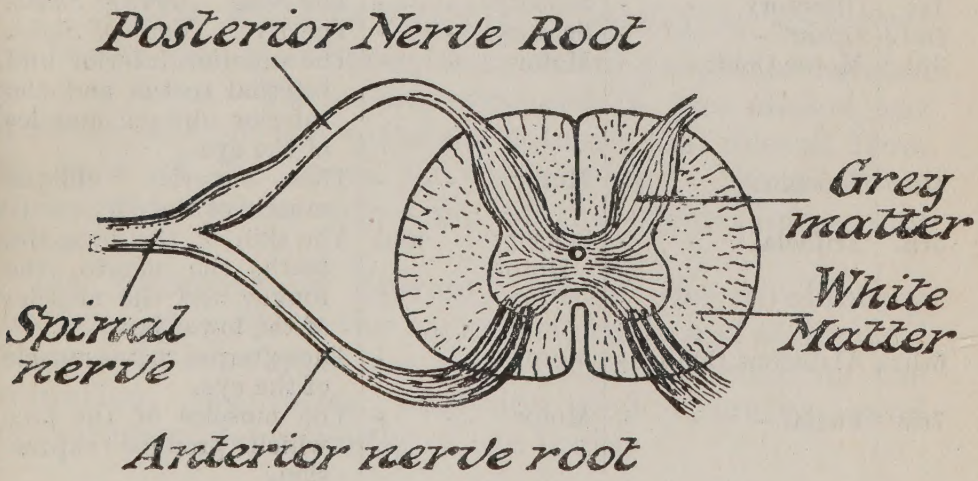


Fig. 58.

Section through the Spinal Cord.

On making a transverse section of the cord, the grey matter will be seen on the inside and the white outside. **The grey matter** is arranged in a central mass from which an *anterior and a posterior horn* project on each side. From these horns nerve fibres are given off, called the *anterior and posterior roots*, which by joining form a *spinal nerve*. The posterior root presents a small swelling called the *ganglion*.

In the centre of the cord is a *canal* which runs throughout its length.

NERVES are given off both from the brain and from the spinal cord.

1. THE CRANIAL NERVES are given off from the brain and consist of 12 pairs. They supply chiefly the organs of the special senses, the head and the organs of circulation and respiration.

TABLE OF THE CRANIAL NERVES.

No	Name.	Action.	Distribution.
1st	Olfactory	Sensory	The Nose. *Nerve of Smell.*
2nd	Optic	Sensory	The Eye. *Nerve of Sight.*
3rd	Motor Oculi	Motor	The superior, inferior and internal rectus and the inferior oblique muscles of the eye.
4th	Trochlear	Motor	The superior oblique muscle of the eye.
5th	Trifacial	Sensory and Motor.	The skin of the face, the teeth, the mouth, the tongue, and the muscles of the lower jaw.
6th	Abducens Oculi	Motor	The external rectus muscle of the eye.
7th	Facial	Motor	The muscles of the face which produce expression.
8th	Auditory	Sensory	The Ear. *Nerve of Hearing.*
9th	Glosso-pharyngeal	Sensory and Motor.	The mucous membrane and muscles of the pharynx. The Tongue. *Nerve of Taste.*
10th	Pneumogastric or Vagus.	Sensory and Motor.	The larynx, heart, lungs œsophagus and stomach.
11th	Spinal accessory	Motor	The sterno-mastoid and trapezius muscles.
12th	Hypoglossal	Motor	The muscles of the neck and tongue.

2. THE SPINAL NERVES are given off from the spinal cord by two roots and pass out between the adjacent vertebræ. There are 31 pairs, named after the region of the spine from which they emerge.

Cervical Nerves	- - -	8 pairs.
Dorsal „	- - -	12 „
Lumbar „	- - -	5 „
Sacral „	- - -	5 „
Coccygeal „	- - -	1 pair.
	Total -	31 pairs.

The Spinal Nerves supply the skin and all the voluntary muscles of the body, except where supplied by the Cranial Nerves.

II.—THE SYMPATHETIC NERVOUS SYSTEM consists of masses of nerve tissue called *ganglia* connected by *nerve fibres*. These are arranged in two chains, one on either side of the vertebral column, and extend from the base of the brain to the coccyx. Nerve fibres connect this system with some of the cranial and spinal nerves.

The Sympathetic System controls the involuntary muscles, and supplies the various thoracic and abdominal viscera. It regulates the vital functions—such as the circulation, respiration, secretion and excretion—and works quite independently of the brain.

THE ORGANS OF THE SPECIAL SENSES.

These organs are the Skin, Tongue, Nose, Ears and Eyes; and are concerned in the senses of touch, taste, smell, hearing, and sight respectively.

THE SKIN, TONGUE, AND NOSE have already been described.

THE EARS are the special organs of the sense of hearing, and each is divided into three parts—the external, middle and internal ear.

THE EXTERNAL EAR consists of the auricle, or pinna and the auditory canal. **The Pinna** is composed of thin plate of cartilage covered with skin, and its use i to conduct sound into the auditory canal.

The Auditory Canal extends from the pinna to th tympanum. It is about $1\frac{1}{4}$ inches in length, is compose partly of cartilage and partly of bone, and is lined wit skin. In this skin are numerous glands which secret the ear-wax.

THE MIDDLE EAR is a cavity in the temporal bon It is separated from the external ear by the **Tympani Membrane**, or drum, which consists of a delicat

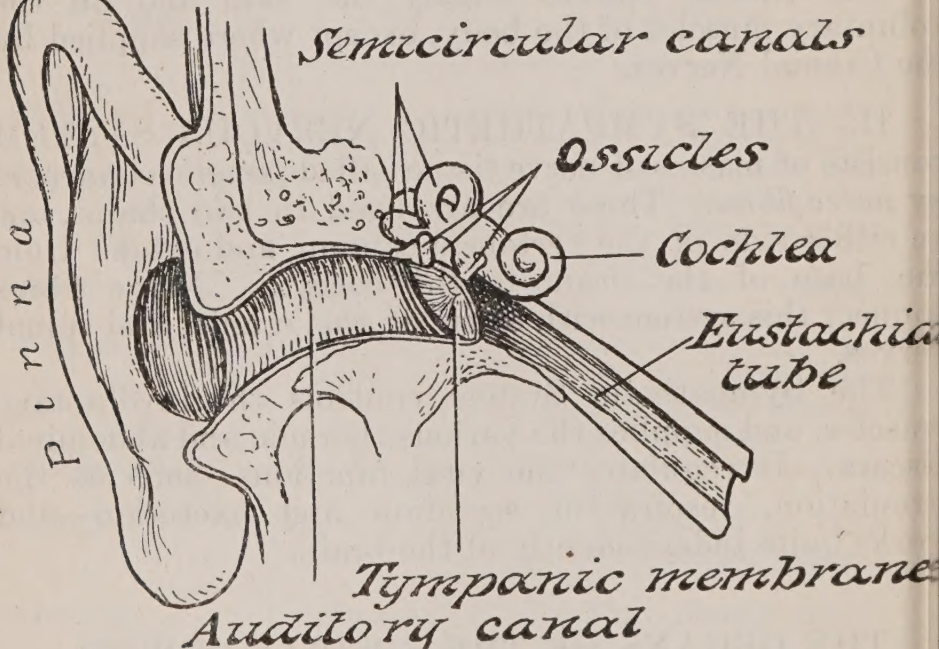
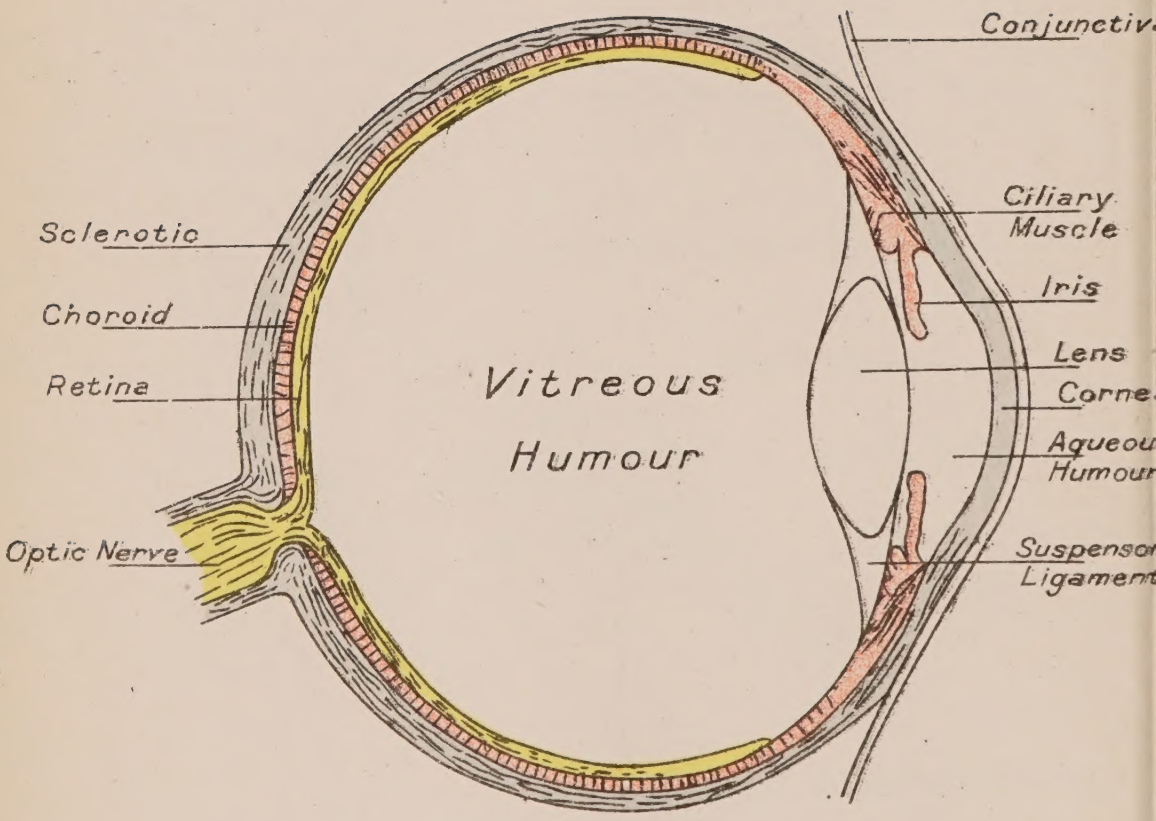


Fig. 59.
Section through the Ear.

membrane entirely closing the auditory canal Co necting the tympanum with the internal ear is a cha of three little bones called the **Ossicles.**

The Middle Ear contains air which arrives throug the **Eustachian Canal** from the pharynx. There therefore air on each side of the tympanum.



SECTION THROUGH THE EYE.

Fig 60.

Malby & Sons, L

THE INTERNAL EAR is a complicated cavity which contains the terminations of the auditory nerve. It consists of a central cavity which communicates with three Semicircular Canals and with a spiral tube like a shell, called the Cochlea.

THE EYE is the special organ of the sense of sight.

The Eyeball is globular in shape and lies in the cavity of the orbit embedded in fat.

It has three incomplete coats—the Sclerotic, the Choroid, and the Retina.

(1) The Sclerotic or outer coat is composed of opaque fibrous tissue, which tends to maintain the shape of the eyeball. It covers only the posterior five-sixths of the eye, the anterior one-sixth being occupied by the Cornea.

The Cornea consists of transparent fibrous tissue. It is continuous with the sclerotic, and bulges slightly from the general curve of the eyeball.

(2) The Choroid or middle coat consists of connective tissue, in which are numerous blood vessels and pigment cells. It is dark brown in colour and prevents light from being reflected from the interior of the eye. It, again, covers only the posterior five-sixths of the eye and ends in a fold called the *Ciliary Process.* The anterior one-sixth is occupied by the Iris.

The Iris is a circular pigmented curtain, continuous with the choroid, and lies behind the cornea. It varies in colour in different people, from light blue to dark brown; and in the centre is a round hole called the *Pupil.*

The Iris contains two sets of involuntary muscles. In one set the muscular fibres radiate like the spokes of a wheel and, by contracting, increase the size of the pupil; in the other, the fibres are arranged in circles round the pupil and, by contracting, diminish the size of the pupil.

(3) **The Retina** or inner coat consists of the terminal branches of the optic nerve, which are spread out over the interior of the eyeball. This nerve enters the back of the eye and pierces the sclerotic and choroid coats.

In the interior of the eyeball are the lens and the two fluids called *humour*.

The Lens is a transparent body, convex on either side, suspended behind the pupil. It is elastic and so can be made to alter in thickness. It is suspended by a circular ligament attached to the ciliary process of the choroid. Running from the posterior edge of the cornea to the ciliary process is the **Ciliary Muscle.** When this muscle contracts it draws on the ciliary process and relaxes the tension on the suspensory ligament, and the lens, by its elasticity, becomes thicker.

The lens divides the eyeball into two separate chambers. The anterior chamber is the smaller and contains a thin watery fluid called the *Aqueous Humour*. The posterior chamber forms about four-fifths of the entire globe, and is filled with a transparent jelly-like substance called the *Vitreous Humour*.

The Appendages of the Eye include the eyelids, the conjunctiva, the muscles, and the lachrymal apparatus.

The Eyelids are two folds which, when closed, protect the eye from injury They are composed of skin on the outer side and conjunctiva on the inner, between which are muscles to raise the edge and thin plates of cartilage. On the free edge of the eyelids are the eyelashes.

The Conjunctiva is a thin layer of mucous membrane which lines the inner surface of the eyelids and is then reflected over the front of the eyeball. Over the cornea it is transparent and consists of only one layer of cells.

The Orbital Muscles are six in number, viz. :—The superior, inferior, external and internal recti, and the

superior and inferior oblique muscles. Their actions are as follows :—

The Superior	Rectus	turns	the	eye	upwards.
The Inferior	„	„	„	„	downwards.
The External	„	„	„	„	outwards.
The Internal	„	„	„	„	inwards.
The Superior	Oblique	„	„	„	downwards and outwards.
The Inferior		„	„	„	upwards and outwards.

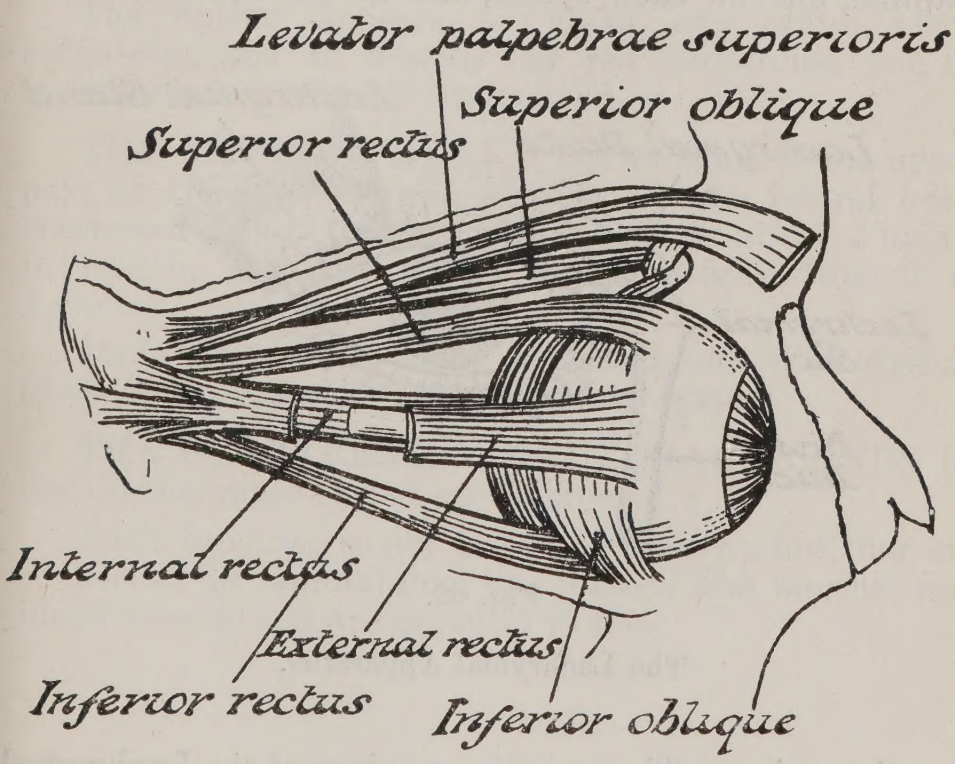


Fig. 61.

The Muscles of the Orbit.

By the combined action of any of these muscles the eye can be rotated in every direction. Both eyes move in the same direction, so that, on looking to the right, the right external rectus and the left internal rectus muscles contract together. These muscles are all controlled by cranial nerves.

The Lachrymal Apparatus consists of the lachrymal gland, which secretes the tears, and the various ducts which conduct the tears into the nose.

The Lachrymal Gland is situated at the upper part of the outer angle of the orbit. It is provided with several small ducts, which open on to the conjunctiva, between the eyeball and the upper eyelid.

The tears then pass over the front of the eyeball to the inner angle of the eye. Here may be seen two little papillæ, one on each eyelid, and at the apex of each a

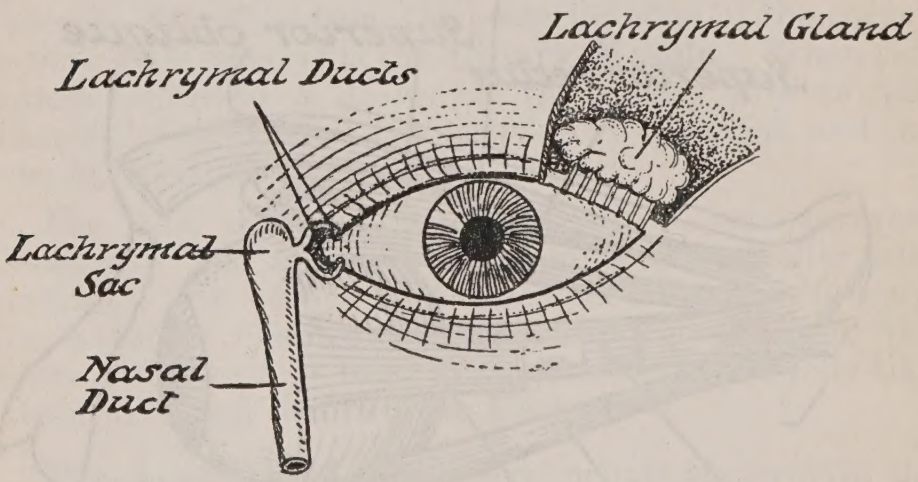


Fig. 62.

The Lachrymal Apparatus.

small opening. These are the openings of the **Lachrymal Ducts** which unite and enter a small cavity at the side of the nose, called the **Lachrymal Sac.** From this cavity a canal, called the **Nasal Duct,** leads the tears into the nose.

Tears are always being secreted, but are not visible, as they are carried away by the nasal duct. When there is excessive secretion, the ducts cannot carry the tears away quickly enough, and they are then visible, and may overflow on to the cheeks.

THE DUCTLESS GLANDS.

THE SPLEEN, or milt, is a flattened oblong organ of a dark bluish-red colour, which lies on the left side of the abdomen, close to the cardiac end of the stomach. It is about 5 inches in length, 3 in breadth, and 1 in thickness, and weighs 7 ounces.

It is composed of a network of connective tissue, enclosing spaces filled with a spongy tissue called *spleen-pulp*, through which the blood flows.

The Spleen appears to make new white blood corpuscles, and to destroy old red corpuscles, but its function is not properly understood.

THE THYROID GLAND lies in front of the upper part of the trachea, and consists of two lateral *lobes*, connected by an *isthmus*. Each lobe is about 2 inches in length, and the whole gland weighs from 1 to 2 ounces.

Its function seems to be connected with the nutrition of the body, especially of the nervous system.

THE SUPRARENAL or ADRENAL GLANDS lie one on the upper end of each kidney.

Their function is not definitely known; but they are concerned in maintaining the tone of the muscles and blood vessels, and are essential to life.

Chapter II.

PHYSIOLOGY.

Physiology is the science which deals with the functions of the human body.

MOVEMENT.

All movements of the body are caused by the contraction of muscles, the bones to which they are attached acting as levers. A lever may be defined as a rigid bar, which is capable of movement around a fixed point called the *fulcrum*. The movement is caused by some *power* applied at one point, which must overcome a *weight* or other resistance acting at another point.

There are three orders of levers:—

(1) **Levers of the First Order** have the fulcrum between the power and the weight, like the beam in a pair of scales.

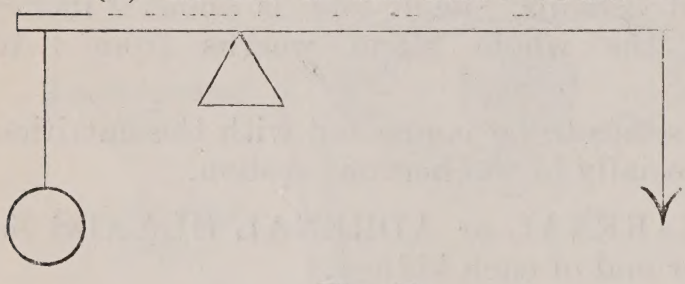


Fig. 63.
Lever of the First Order.

(2) **Levers of the Second Order** have the weight between the power and the fulcrum, as in lifting the handles of a wheel-barrow.

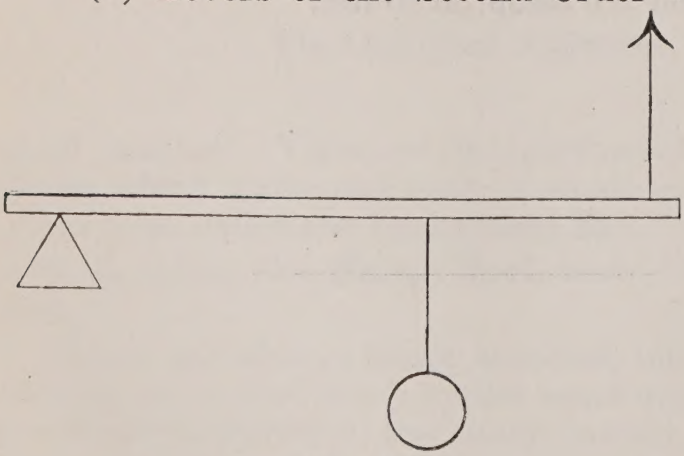


Fig. 64.
Lever of the Second Order.

(3) **Levers of the Third Order** have the power between the weight and the fulcrum, as in the treadle of a sewing-machine.

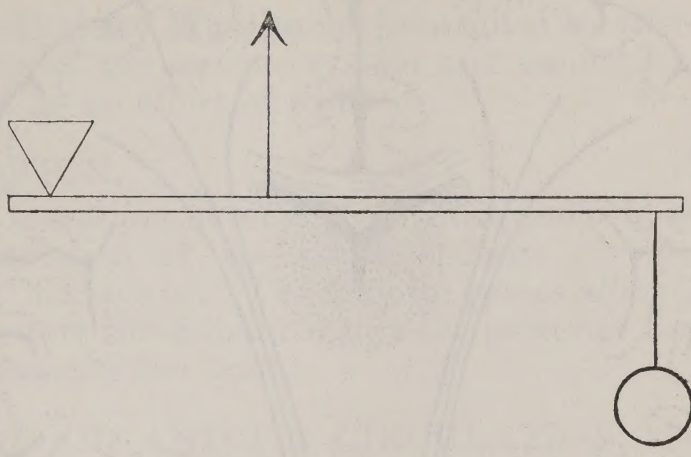


Fig. 65.
Lever of the Third Order.

In the body the fulcrum is at a joint, the muscles supply the power, and the resistance is the weight of the whole, or part of the body. These remarks apply to the voluntary muscles, as the involuntary muscles are not attached to bone.

Voluntary Muscles are controlled by the nerves of the cerebrospinal system. The will to make a movement originates in the brain. The impulse passes down through the medulla and spinal cord, which it leaves by one of the anterior nerve roots. It then proceeds by the nerve supplying those muscles, which, by contracting, produce the desired movement. As the fibres from one side of the brain cross to the opposite side in the medulla, the impulse to contract a muscle on the right side of the body must originate on the left side of the brain, and *vice versâ*.

It is known that certain areas of the surface of the brain control definite groups of muscles. These are called the *motor areas* of the brain. Thus, stimulating a certain part of the right side of the brain will cause movement of the left arm; stimulating a certain part of the left side of the brain will cause movement of the right leg, and so on.

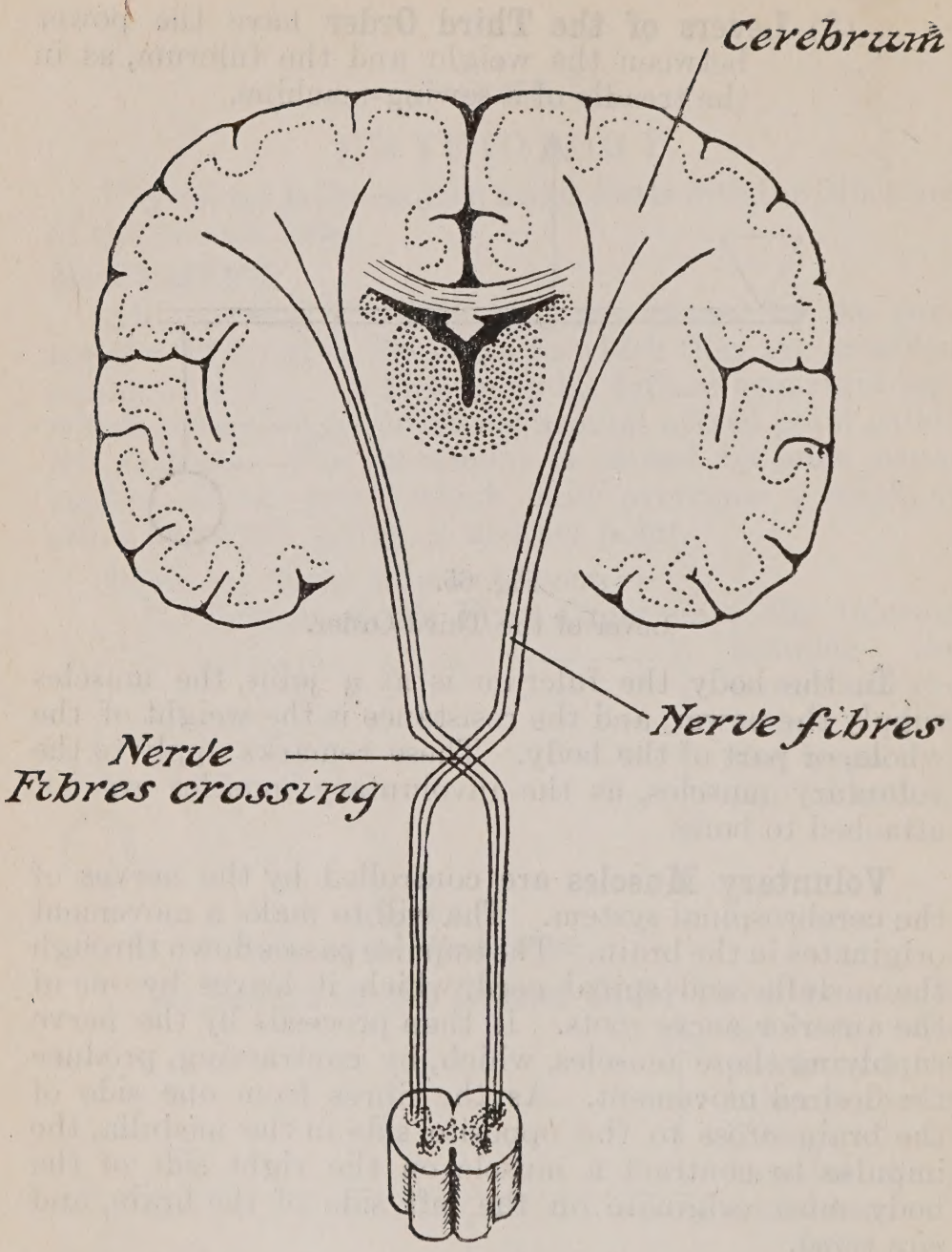


Fig. 66.
Crossing of Nerve Fibres.

If the skin of certain parts of the body be stimulated movement of adjacent muscles occurs. This is called *reflex action.* The stimulus is carried by sensory nerves

from the skin to the brain, and there a motor impulse is produced which is carried down to the muscle and causes it to contract.

Involuntary Muscles are controlled by the nerves of the sympathetic nervous system and cannot be made to contract by an effort of will.

SENSATION.

The sensations of touch, pain, heat, and cold are caused by stimulation of the nerve endings in the skin or mucous membrane. The impulse passes along a sensory nerve, enters the spinal cord by the posterior nerve roots, and so reaches the brain.

THE BLOOD AND ITS CIRCULATION.

The Uses of Blood.

(1) It absorbs nutriment from the food and carries it to all parts of the body.

(2) It absorbs oxygen from the air in the lungs and carries it to all parts of the body.

(3) It absorbs waste matter from the tissues and carries it to the organs of excretion for removal from the body.

(4) It distributes and maintains the heat of the body.

(5) It provides moisture for the various tissues.

In order to perform these functions blood must circulate through the body. It is forced by the heart through the arteries and capillaries, and returns to the heart through the veins, thus completing an endless circle. This is called the **Circulation of the Blood.**

When the heart muscle contracts it causes what is commonly called a *beat.* This heart beat may be divided into three stages, which occur in the following order :—

(1) Both auricles contract and force their contents into the ventricles.

(2) Both ventricles contract and force their contents into the aorta and pulmonary arteries.

(3) A pause, during which the auricles refill.

The beat which can be felt is caused by the contraction of the ventricles.

The heart beats at the rate of about 72 times a minute, and this forcible expulsion of blood from the heart sets up a wave in the arteries which is called the *pulse*. The pulse can be felt in any superficial artery.

There are four circulations in the body:—

(1) The Systemic Circulation.
(2) The Pulmonary Circulation.
(3) The Portal Circulation.
(4) The Coronary Circulation.

1. The Systemic Circulation is the largest. The blood leaves the left ventricle by the aorta as bright scarlet arterial blood, and, after passing to all parts of the body, returns to the right auricle by the venæ cavæ as dark purple venous blood. The arterial blood contains oxygen and nutriment which it gives up to the tissues through the capillaries, and collects carbonic acid gas and other waste matter which cause the change in colour to dark purple.

The chief arteries and veins through which the blood passes in the systemic circulation have been described under the Organs of Circulation (p. 44).

2. The Pulmonary Circulation.—In this the blood flows from the heart to the lungs and back to the heart again. The blood is forced by the right ventricle through the pulmonary arteries to the lungs, and returns through the pulmonary veins to the left auricle. This circulation is concerned in Respiration (*see* p. 88).

3. The Portal Circulation.—Some of the blood which leaves the heart by the aorta reaches the spleen, stomach, and intestines, where it collects nutriment from the food. It is then collected by the splenic, gastric, and mesenteric veins which unite to form one large vessel, the portal vein. This vessel enters the liver, and the blood, after circulating in that organ, is returned to the right auricle through the hepatic vein and the inferior vena cava. This circulation is concerned in Digestion (*see* p. 95).

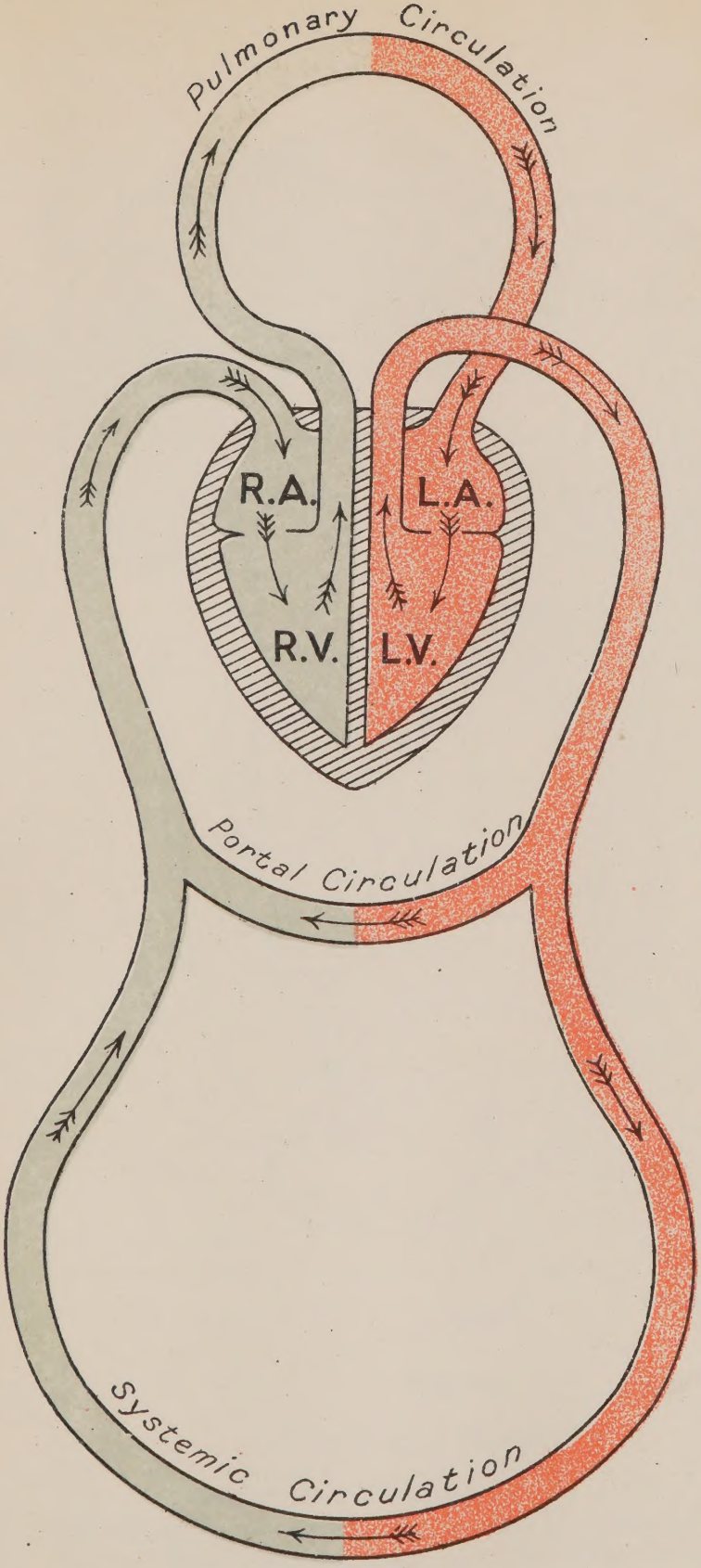


DIAGRAM OF THE VARIOUS CIRCULATIONS

ht. A = Auricle.
't. V = Ventricle.

Fig 67.

Red. Arterial Blood
Blue. Venous Blood

Malby & Sons, Lith.

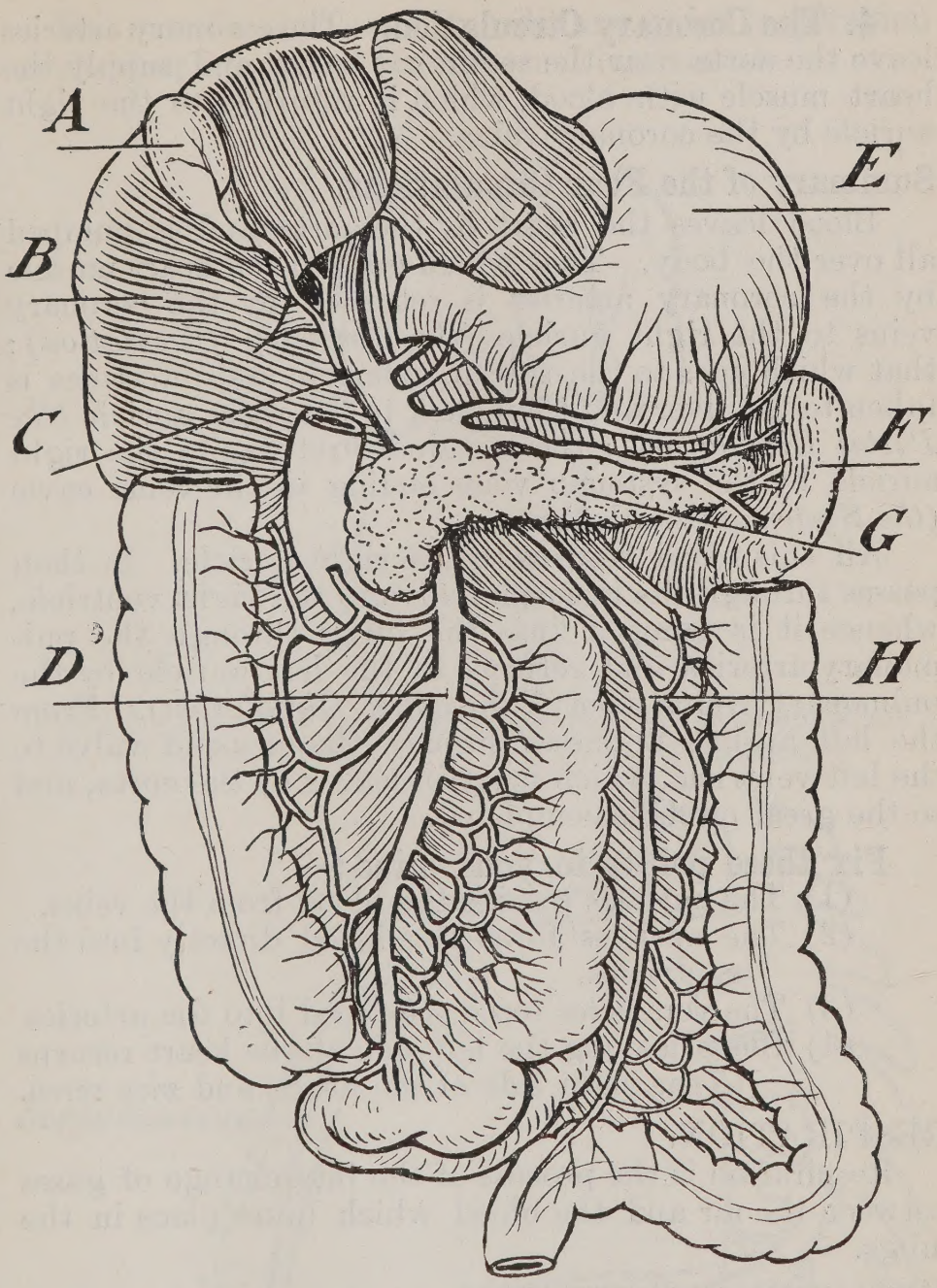


Fig. 68.

The Portal Circulation.

A.—The Gall Bladder. B.—The Liver.
C.—The Portal Vein. D. and H.—Mesenteric Veins.
E.—The Stomach. F.—The Spleen.
G.—The Pancreas.

4. The Coronary Circulation.—The coronary arteries leave the aorta near the semilunar valve, and supply the heart muscle with blood, which is returned to the right auricle by the coronary veins.

Summary of the Four Circulations.

Blood leaves the heart by the aorta and is pumped all over the body. That which goes to the heart muscle by the coronary arteries is returned by the coronary veins to the right auricle (*the Coronary Circulation*); that which goes to the spleen, stomach, and intestines is taken to the liver and then back to the right auricle (*the Portal Circulation*); the remainder returns to the right auricle by the systemic veins ending in the venæ cavæ (*the Systemic Circulation*).

All this blood returns to the right auricle. It then passes through the tricuspid valve to the right ventricle, whence it is pumped into the lungs through the pulmonary arteries, and returns to the left auricle by the pulmonary veins (*the Pulmonary Circulation*). From the left auricle it passes through the bicuspid valve to the left ventricle, which it again leaves by the aorta, and so the great circle is completed.

Fix these points in your mind:—

(1) The auricles receive the blood from the veins.
(2) The auricles force the blood directly into the ventricles.
(3) The ventricles force the blood into the arteries
(4) Blood leaving the left side of the heart returns to the right side of the heart, and *vice versâ*.

RESPIRATION.

Respiration is the process of the interchange of gases between the air and the blood which takes place in the lungs.

MECHANISM OF RESPIRATION.

Air is drawn into the lungs by the act of *inspiration*, and expelled by *expiration*.

Inspiration is a purely muscular effort. The size of the thorax is increased in every dimension, and so air rushes in through the air passages to fill the increased space, and the lungs expand.

The muscles concerned in **ordinary quiet inspiration** are the diaphragm and the external intercostals.

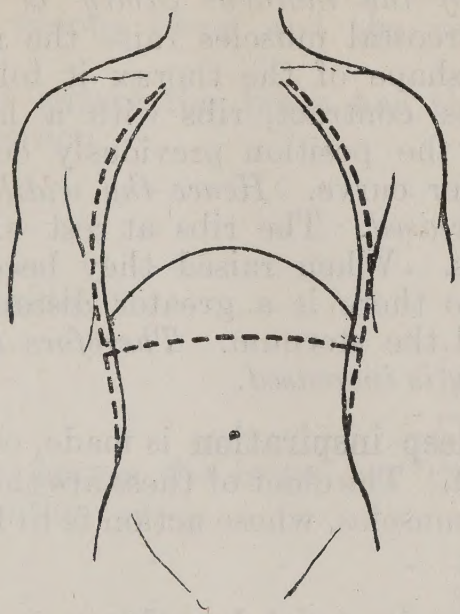


Fig. 69.—Action of the Diaphragm and Ribs in Respiration.
- - - - Inspiration. —— Expiration.

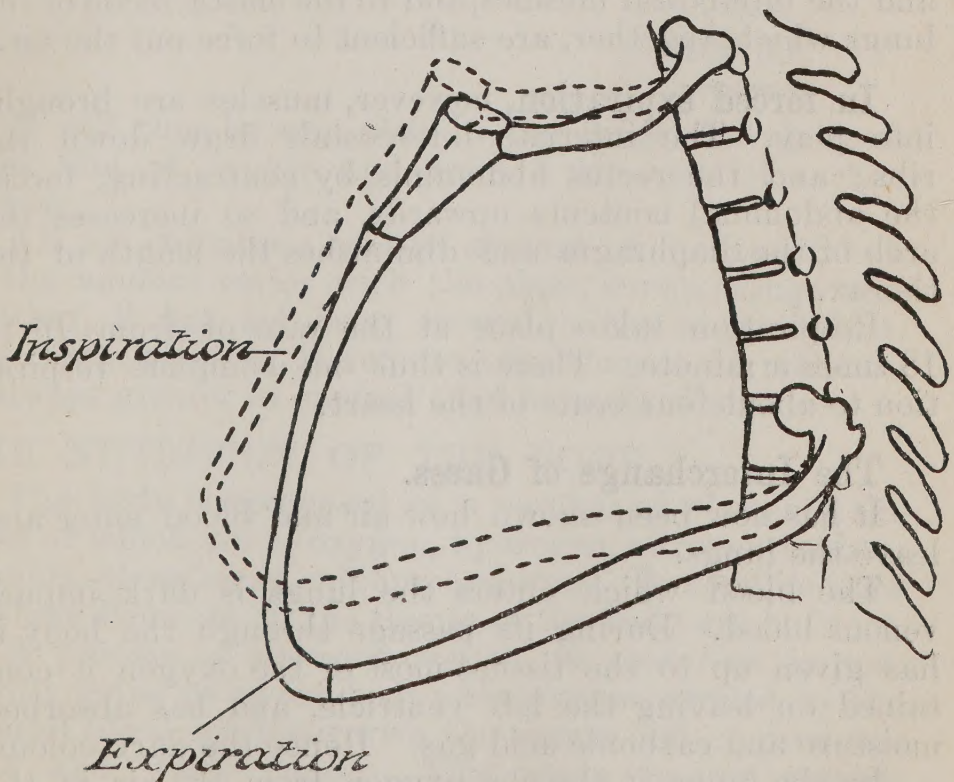


Fig. 70.—Action of the Ribs in Respiration.

When the diaphragm contracts, it becomes flattened instead of being arched upwards into the chest. *Thus the length of the thoracic cavity is increased.* The external intercostal muscles raise the ribs. Owing to the conical shape of the thorax it follows that when these muscles contract, ribs with a larger curve are brought into the position previously occupied by those with a smaller curve. *Hence the width of the thoracic cavity is increased.* The ribs at rest slope downwards and forwards. When raised they become more horizontal, and so there is a greater distance between the vertebræ and the sternum. *Therefore the depth of the thoracic cavity is increased.*

When a **deep inspiration** is made, other muscles are also employed. The chief of these are the sterno-mastoid and pectoral muscles, whose action is to further raise the ribs.

Expiration, in quiet breathing, is not a muscular effort; but is due to the relaxation of the diaphragm and the intercostal muscles, and to the elastic recoil of the lungs which, together, are sufficient to force out the air.

In forced expiration, however, muscles are brought into play. The internal intercostals draw down the ribs; and the rectus abdominis, by contracting, forces the abdominal contents upwards, and so increases the arch of the diaphragm and diminishes the length of the thorax.

Respiration takes place at the rate of from 16 to 18 times a minute. There is thus one complete respiration to about four beats of the heart.

The Interchange of Gases.

It has now been shown how air and blood enter and leave the lungs.

The blood which enters the lungs is dark impure venous blood. During its passage through the body it has given up to the tissues most of the oxygen it contained on leaving the left ventricle, and has absorbed moisture and carbonic acid gas. Hence the dark colour.

In the lungs, it absorbs oxygen from the air in the alveoli and gives up the carbonic acid gas and moisture;

and so the blood which leaves the lungs is bright arterial blood.

Remember that in the pulmonary circulation the arteries contain venous blood and the veins arterial blood.

The air which **enters** the lungs has the following percentage composition :—

Oxygen - - - -	20·96
Nitrogen - - - -	78·00
Argon - - - -	1·00
Carbon dioxide - - -	·04
	100·00

The air which **leaves** the lungs has the following percentage composition :—

Oxygen - - - -	17·00
Nitrogen - - - -	78·00
Argon - - - -	1·00
Carbon dioxide - - -	4·00
	100·00

It will thus be seen that in the lungs the air loses 4 per cent. of oxygen and gains 4 per cent. of carbon dioxide.

All air contains a certain amount of moisture; but, as the amount varies with the place, surroundings and weather, it has not been shown in the above tables. One thing, however, is definite: the amount of moisture is always greater in expired than in inspired air.

THE NUTRITION OF THE BODY.

The body is composed of a number of elements, the chief of which are :—oxygen, hydrogen, nitrogen, carbon, calcium, phosphorus, sulphur, and iron. By combinations of these elements all the tissues of the body are built up.

A process of slow combustion, or *oxidation*, is constantly going on in the body; the oxygen carried in the arterial blood combines with the tissues and so produces heat and waste matter. This waste matter consists

chiefly of water, carbon dioxide, and urea, which, as will be seen presently, are excreted from the body by the skin, lungs, and kidneys.

To maintain life, this loss of tissue must be replaced; and so we take in oxygen and food.

FOOD.

The various forms of food may be divided into two divisions, organic and inorganic.

1. **Organic Foods** are those which have had life, and may be animal or vegetable. They are divided into three classes.

   (*a*) **Proteids** consist of carbon, hydrogen, oxygen, and nitrogen, and so are also called *nitrogenous* foods. They are found in such articles of diet as the white of egg, lean meat, cheese, milk, peas, and beans.

   (*b*) **Carbohydrates** consist of carbon, hydrogen and oxygen, and so are also called *non-nitrogenous* foods. They form all kinds of sugar and starch, which latter is found in flour, bread, rice, sago, potatoes, and other root vegetables.

   (*c*) **Fats** consist of carbon, hydrogen and oxygen, and so also belong to the *non-nitrogenous* foods. They are supplied mostly in the form of the fat of meat and butter.

2. **Inorganic Foods** are those which have never had life. There are two classes.

   (*d*) **Water.** This is present in all forms of food, but is also employed as a beverage.

   (*e*) **Salts.** The chief salts are the chlorides and phosphates of sodium and potassium. They are contained in most organic foods, but sodium chloride is generally taken separately as "common salt."

Uses of the various Foods.

(*a*) **Proteids** are the only foods which form tissue. They also produce heat.

(*b*) **Carbohydrates** produce heat and help in the formation of fat.

(*c*) **Fats** produce heat.

(*d*) **Water** supplies the body with moisture. It keeps the tissues soft and flexible, and also dissolves the products of digestion and so assists absorption and excretion.

(*e*) **Salts** are used chiefly in the formation of the bones and teeth.

DIGESTION.

By digestion we mean the changes which take place in the crude foods as taken into the mouth, so as to render them soluble and capable of being absorbed.

Digestion takes place in the mouth, in the stomach, and in the intestines.

IN THE MOUTH.

When food enters the mouth it is chewed, or *masticated*, by the teeth, and mixed with saliva from the salivary glands. **Saliva** is a watery, alkaline, and rather slimy fluid which contains a ferment called **Ptyalin.** This ferment has the power of converting starch (insoluble) into sugar (soluble). Saliva also moistens the mouth and so aids speaking and swallowing; it dissolves some of the salts, and is a mild antiseptic.

After being masticated by the teeth and moistened with saliva, the food is formed into a ball by the tongue and passed backwards into the pharynx and œsophagus. This is called the act of swallowing, or *deglutition.* Swallowing is a muscular effort: the food does not fall down the œsophagus. At the commencement of the act it will be noticed that the larynx moves upwards. This allows the epiglottis to fall over the opening of the larynx and prevents food passing into it. At the same time the soft palate rises and shuts off the posterior nares, so that the œsophagus is the only road left for the food to take.

IN THE STOMACH.

It has been already stated that the mucous membrane of the stomach contains glands which secrete gastric juice.

Gastric Juice is a clear acid fluid with a saltish taste, and contains a ferment called **Pepsin.** This ferment has

the power of converting the insoluble proteids into a soluble form, called *Peptones*. The food is kept constantly in motion by the contraction of the muscular walls of the stomach. It becomes thoroughly mixed with the gastric juice and forms a milky fluid called *Chyme*, which, after a few hours, is forced through the pylorus.

In the Small Intestine.

In the Duodenum, the Chyme meets with the Bile and the Pancreatic Juice.

Bile is secreted by the Liver. After passing down the hepatic duct, some enters the intestine by the common bile duct, the remainder being stored in the gall bladder for future use. It is a greenish-yellow alkaline fluid with a very bitter taste. The action of bile is to emulsify fats; that is, it breaks up the fat into minute globules, which can then be absorbed. Bile is also a powerful intestinal antiseptic and is a natural purgative.

Pancreatic Juice is secreted by the Pancreas, and enters the Duodenum by the Pancreatic Duct with the common bile duct. It is a clear alkaline fluid, and contains three ferments which act on all forms of organic foods. These ferments are:—

(*a*) **Amylopsin,** which converts starch into sugar.

(*b*) **Trypsin,** which converts proteids into peptones.

(*c*) **Steapsin,** which emulsifies fats.

When the food has been acted upon by these ferments it is called *Chyle*, and is further acted upon by the Intestinal Juice which has a similar action to Pancreatic Juice. The food is slowly forced along the intestine by the contraction of its muscular coat. This muscular movement is called *Peristalsis*. During its passage through the small intestine, the digested—that is, soluble—portions are gradually absorbed by the lacteals, and the remainder (still very watery) is forced through the ileo-cæcal valve into the large intestine.

In the Large Intestine.

Here also absorption takes place, especially the absorption of water. During its passage through the large intestine the remains of the food become more

solid; and, in from 36 to 48 hours after being taken into the stomach, is passed out through the anus as *fæces*. The passing of fæces is called *defæcation*.

SUMMARY OF DIGESTION.

Every form of organic food is acted upon by two ferments—one in the pancreatic juice and one other.

Proteids are converted into Peptones by—

(1) Trypsin in the pancreatic juice.
(2) Pepsin in the gastric juice.

Starches are converted into Sugar by—

(1) Amylopsin in the pancreatic juice.
(2) Ptyalin in the saliva.

Fats are emulsified by—

(1) Steapsin in the pancreatic juice.
(2) Bile.

Sugar and Salts are simply dissolved unchanged by all the digestive juices.

ABSORPTION.

When the foodstuffs are rendered soluble they are absorbed from the intestine into the blood stream; but not all in the same way:—

(1) **Sugar** and **Salts** pass directly into the capillaries of the intestine, whence they are carried by the portal vein to the liver. Here the sugar is converted into a substance called *Glycogen*, which is sent to the heart by the hepatic vein for distribution in the body as required.

(2) **Peptones** and **Emulsified Fats** are absorbed by the lacteals or lymphatic vessels in the villi of the intestine. They are then conducted by other lymphatics to the receptaculum chili, pass up the thoracic duct, and enter the left subclavian and internal jugular veins.

EXCRETION.

By excretion is meant the separation of waste matter from the blood and its removal from the body. The waste matter consists of water, carbon dioxide, and urea.

Excretion must not be confounded with secretion, which is the manufacture of substances from the blood for use in the body: such as bile, saliva, synovial fluid, &c.

The Organs of Excretion are the lungs, the skin, and the kidneys.

The Lungs excrete carbon dioxide and water, as described under Respiration.

The Skin excretes water by the sudoriferous glands in the form of perspiration or sweat. Perspiration is constantly going on, but is not visible except when excessive, as the moisture evaporates from the surface of the body as soon as it is excreted.

Sweat contains a small amount of carbon dioxide and urea.

The uses of sweat are—

(1) to cleanse the skin.
(2) to cool the skin by evaporation.

Excessive or visible sweating is called *Diaphoresis*, and is caused by—

(1) the application of heat.
(2) exercise.
(3) certain drugs called Diaphoretics.
(4) certain diseases, especially fevers.

The Kidneys excrete water and urea, which together form urine. Urea is a compound of carbon, hydrogen, oxygen, and nitrogen (the same elements as in food), and is formed chiefly in the muscles as the result of exercise. From the muscles it passes by the blood to the kidneys. In the glomeruli of the kidneys the urea is abstracted from the blood in the capillaries, and passes into the uriniferous tubules which empty into the pelvis of the kidney. The urine is constantly trickling down the ureters into the bladder which, when full, is emptied through the urethra in the act of *micturition*.

Urine is a pale, straw-coloured fluid, acid in reaction, and having a specific gravity of from 1015 to 1025. The average amount passed per day is 50 ounces, which contain about 500 grains (or, roughly, 1 ounce) of urea.

VISION.

The eye is practically a camera. Rays of light, after passing through the lens, are focussed on a screen (the retina); and the impressions of form, light, shade, and colour there produced are conducted to the brain by the optic nerve.

To understand the mechanism of vision it is necessary to know the properties of a convex lens :—

(1) Rays of light (which always travel in straight lines), on passing through a convex lens (or magnifying glass) are bent out of their course, so that they finally meet at one point which is called the *focus*. The more convex the lens, the shorter distance will this point be from the lens.

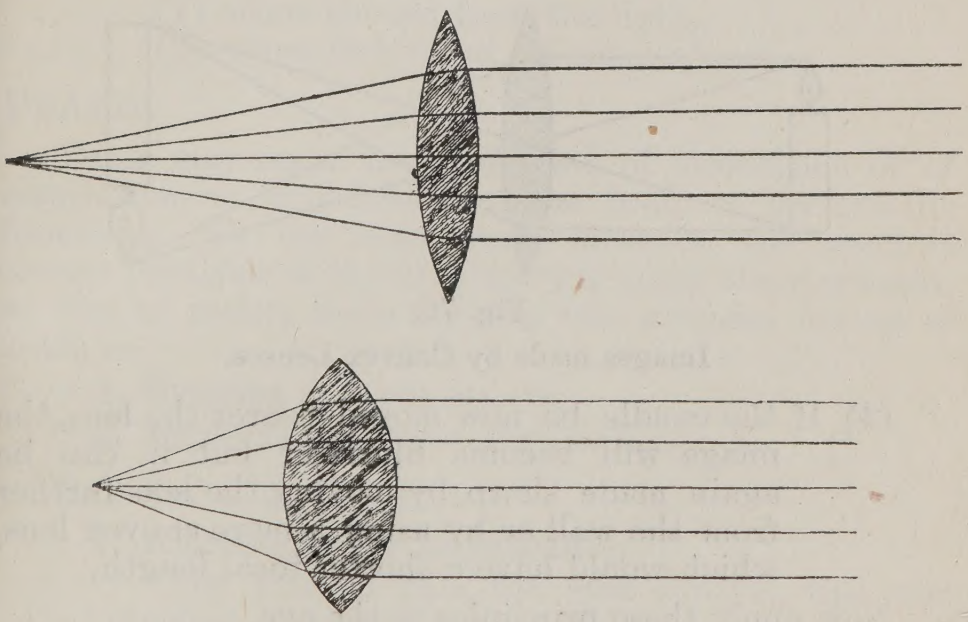


Fig. 71.
Effect of Convex Lenses.

(2) If a dark room be lighted by only one candle placed in the centre, and a lens be held near the wall, by moving the lens nearer the candle a point will be reached when a perfectly sharp image of the candle will appear on the wall.

(3) The image of the candle will appear upside down (inverted) showing that the rays of light have crossed.

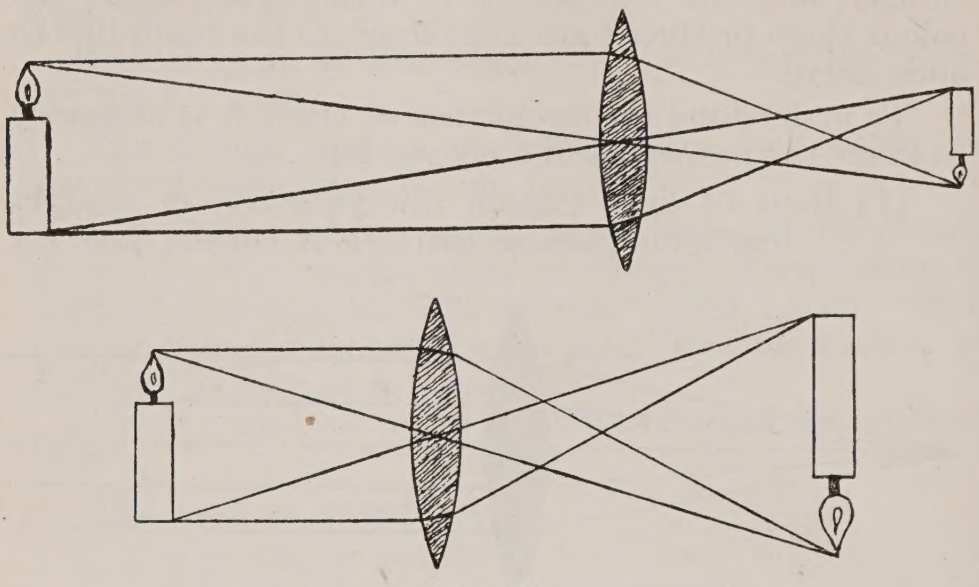


Fig. 72.

Images made by Convex Lenses.

(4) If the candle be now moved nearer the lens, the image will become blurred; but it can be again made sharp by moving the lens further from the wall or by using a more convex lens, which would have a shorter focal length.

Now apply these principles to the eye.

Rays of light from a distant object pass through the crystalline lens, cross and form a sharp inverted image on the retina. Now, if the object be brought nearer, the image should become blurred. This, however, is prevented by the lens becoming more convex, and so focussing the image sharply on the retina; and the nearer the object is to the eye the more convex does the lens become. This is called *accommodation*, and is brought about by the contraction of the ciliary muscle which eases the tension of the suspensory ligament and so allows the elastic lens to bulge. Gazing at a near object is thus a muscular effort and tires the eye.

Cameras, microscopes, magic lanterns, and other optical instruments are all fitted with a *diaphragm*, which

consists of a disc in which are different sized holes, and is used to regulate the amount of light which passes through the lens. It is also found that the smaller the hole the sharper is the image. In the eye, this action is brought about by the iris, which controls the size of the pupil.

The pupil becomes *smaller*
(1) when exposed to light,
(2) when looking at a near object.

The pupil becomes *larger*
(1) when shaded from the light,
(2) when looking at a distant object.

DEATH.

Death may result from cessation of circulation or of respiration, or from failure of the brain to perform its functions. In the latter case, however, the result is always paralysis of the circulatory or respiratory systems, so that in reality there are only two ultimate causes of death :—

1. **Syncope** or heart failure.
2. **Asphyxia** or respiratory failure.

THE SIGNS OF DEATH :—

1. Alterations in Appearance.

The skin is pale, the eyes sunken, the nose pinched, and the lower jaw falls.

2. Cessation of the Heart's Action.

The pulse cannot be felt; the impulse of the heart's apex against the chest wall cannot be felt; the heart sounds cannot be heard on placing the ear to the chest.

3. Cessation of Circulation.

This can be tested by tying a ligature round a finger. During life, the end of the finger becomes blue; in death it remains white.

4. Cessation of Respiration.

Hold a *cold* mirror in front of the nose and mouth. In life the mirror will be dimmed by moisture, but not in death.

5. Alterations in the Eye.

The pupil dilates; the cornea is insensitive and becomes hazy—like frosted glass.

6. Increasing Coldness of the Body.

The body temperature falls at the rate of nearly 2 degrees per hour. If the temperature were rising at the time of death, it may continue to rise for a short time afterwards.

7. Increasing Stiffness of the Body.

This is called *rigor mortis*, and is caused by a hardening of the muscles of the body. It comes on in from 2 to 4 hours after death, and lasts from 1 to 3 days.

8. Post-mortem Staining.

In a dead body, the blood falls by gravity into the most dependent parts, usually the back. The skin becomes dull red or purple in patches, which are apt to be mistaken for bruises.

9. Decomposition of the Body.

The first sign of decomposition occurs in the skin of the abdomen, which, in 2 or 3 days, becomes green in colour. Decomposition is the only absolutely certain sign of death.

Chapter III.

BACTERIOLOGY.

Bacteria are minute *vegetable* organisms, many of which, when introduced into the body, produce disease.

They consist of a minute mass of protoplasm enclosed in a delicate envelope.

Their size may be judged from the fact that the length of even the largest is no more than the diameter of a red blood corpuscle; while their breadth is seldom more than $\frac{1}{25000}$th of an inch, or about $\frac{1}{8}$th of a red corpuscle.

Many of them are capable of movement, some by the action of fine thread-like processes, called *flagella*, with which they are provided; others by being able to contract their protoplasm. For their life and growth they require food (proteids and carbohydrates) and moisture. Some also require oxygen, while others cannot live in it.

They multiply either by splitting into two, or by the formation of spores, which are similar to the seeds of other flowerless plants. They multiply so quickly that one bacterium may, by dividing and subdividing, produce as many as 17,000,000 bacteria in the space of 24 hours.

They grow and develop best at the temperature of the body, being rendered more active by a slight increase in the temperature, and less active when exposed to cold.

Bacteria and their spores are killed by boiling in water for 20 minutes; by exposure to steam under pressure at a temperature of 260° F. for 20 minutes; by exposure to dry heat at a temperature of 340° F. for one hour; and by the action of the various chemical antiseptics and disinfectants. Sunlight alone is fatal to many of them.

Bacteria are classified into three groups according to their shape :—

(1) **Cocci,** which are round;

(2) **Bacilli**, which are rod-shaped ;

(3) **Spirilla,** which are corkscrew-shaped.

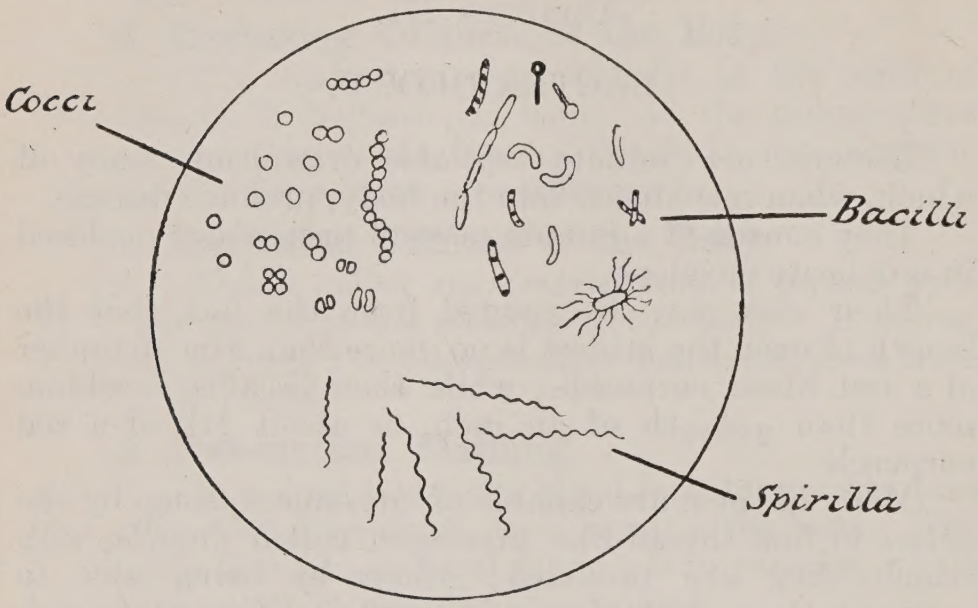


Fig. 73.

Forms of Bacteria.

These minute living organisms, whether capable of producing disease or not, may be found in almost any conceivable place—in the air, in ordinary cold tap water, on the skin, in the soil, on clothing, &c., in fact on every article exposed to the air. This fact must be constantly borne in mind, as on it is based the whole scheme of modern surgery. In every operation and in the treatment of all wounds the universal presence of these minute and invisible bodies must never for a moment be forgotten.

Bacteria gain an entrance to the body through wounds of the skin or mucous membrane, or by the air-passages and alimentary canal. Having found a suitable site they commence to produce poisons called **toxins;** and it is to these toxins that the symptoms of the disease are due. The bacteria may remain in one part of the body, such as a wound or the lungs, or may themselves pass into the blood.

Seeing that these bacteria are so common, it seems wonderful that only a comparatively small number of

people become infected. This is due to various natural causes :—

(1) Bacteria cannot pass through healthy unbroken skin.

(2) They may be washed out of a wound by the flow of blood.

(3) Secretions from mucous surfaces, such as the mouth, have an antiseptic action ; that is, they have the power of killing bacteria.

(4) The white blood corpuscles have the power of devouring and destroying bacteria in limited numbers.

It will thus be seen that even should bacteria gain an entrance into the body they may be incapable of living and producing disease. When, however, the vitality of the patient is lowered, by exposure to cold, by starvation, by alcohol, or by wasting diseases, or when the bacteria enter in large numbers, then the white blood corpuscles are unable to destroy all, and the disease is produced.

Certain bacteria, the chief being the *Bacillus Coli Communis*, are normally present in the intestine. So long as they remain in the intestine they do not cause disease, but seem to prevent the growth of harmful bacteria.

In the modern treatment of disease, dead bacteria and their toxins are largely used. It has been found that if an animal is inoculated with the toxin of certain bacteria, not the bacteria themselves, its blood will in time contain a substance capable of destroying these bacteria. This substance is called an **Antitoxin,** and the serum of the animal's blood which contains this antitoxin is injected into the patient. (*See* the treatment of Diphtheria.)

In some cases the patient is vaccinated with the dead bacteria, which has a similar effect.

In Surgery, the commonest bacteria met with are two forms of cocci, called *Streptococci* and *Staphylococci*, which, when introduced into a wound, cause *pus*, or

matter, to form. These cocci are, therefore, often called the "*germs of suppuration*" or "*septic organisms.*"

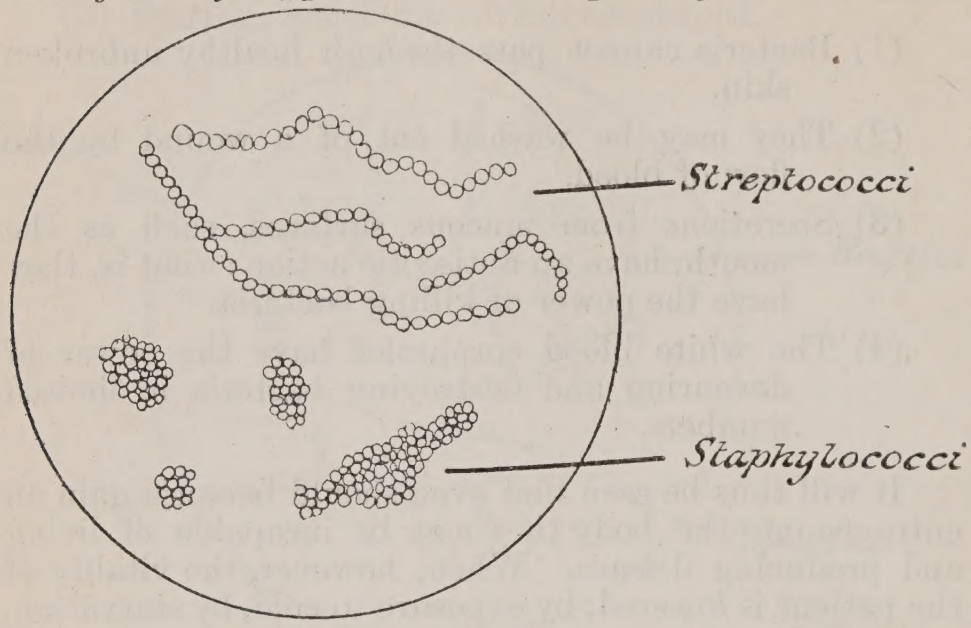


Fig. 74.
The Germs of Suppuration.

When a wound contains none of these bacteria it is said to be *aseptic*; but when it has become infected it is called a *septic* wound.

Sepsis means the presence of septic organisms.

Asepsis means the absence of septic organisms.

Antisepsis means the prevention of the growth and development of these organisms.

From these nouns the following adjectives are derived:—

Septic, meaning infected with the germs of suppuration.

Aseptic, meaning free from the germs of suppuration.

Antiseptic, meaning preventing the growth and development of the germs of suppuration.

Thus, a wound may be septic or aseptic; an instrument, septic or aseptic; a dressing, septic, aseptic, or antiseptic.

The word "antiseptic" is frequently used as a noun, to indicate a chemical with antiseptic properties.

Sterilisation is the term applied to processes for killing bacteria by the action of heat.

Chapter IV.

INFLAMMATION.

Inflammation is the succession of changes which takes place in a living tissue when it is injured, provided that the injury is not so severe as to at once destroy its vitality.

Inflammation might also be described as the evidence of the fight between the tissues and the invading bacteria.

Sequence of Changes in the Tissues.

After an injury has occurred, the blood vessels of the part dilate, so that more blood flows to the part. This causes local redness and heat. The blood stream then flows more slowly and may stop altogether. Before it stops, however, recovery may take place; the blood flows more quickly, the vessels contract, and the part returns to its normal state. This is called **Resolution.** Should the blood stream stop, blood plasma passes through the walls of the capillaries into the tissues and causes swelling and pain. White corpuscles also escape from the vessels and, dying, form pus, and so an abscess is produced. Inflammation may be acute or chronic.

ACUTE INFLAMMATION.

Causes.

(1) Bacteria.
(2) Injury.
(3) Extreme heat or cold.
(4) Electricity and X-rays.
(5) Chemicals, such as acids, alkalies, blistering agents, &c.

Signs and Symptoms.

The four most definite signs of Inflammation are **pain, heat, redness,** and **swelling.** In addition, there will be a rise of temperature, and a rigor is common

when the inflammation is of some internal organ. The pulse is quickened; the urine scanty and high coloured; and the patient suffers from loss of appetite, a furred tongue, constipation, and headache.

Treatment.

A. Local.

1. Remove the cause if possible.
2. Keep the part at rest.
3. The congestion is diminished by :—
   - (*a*) Elevation of the part.
   - (*b*) Incisions.
   - (*c*) Leeches.
   - (*d*) The application of cold.
4. If resolution does not occur and the formation of an abscess is inevitable, heat is applied in the form of fomentations or poultices.

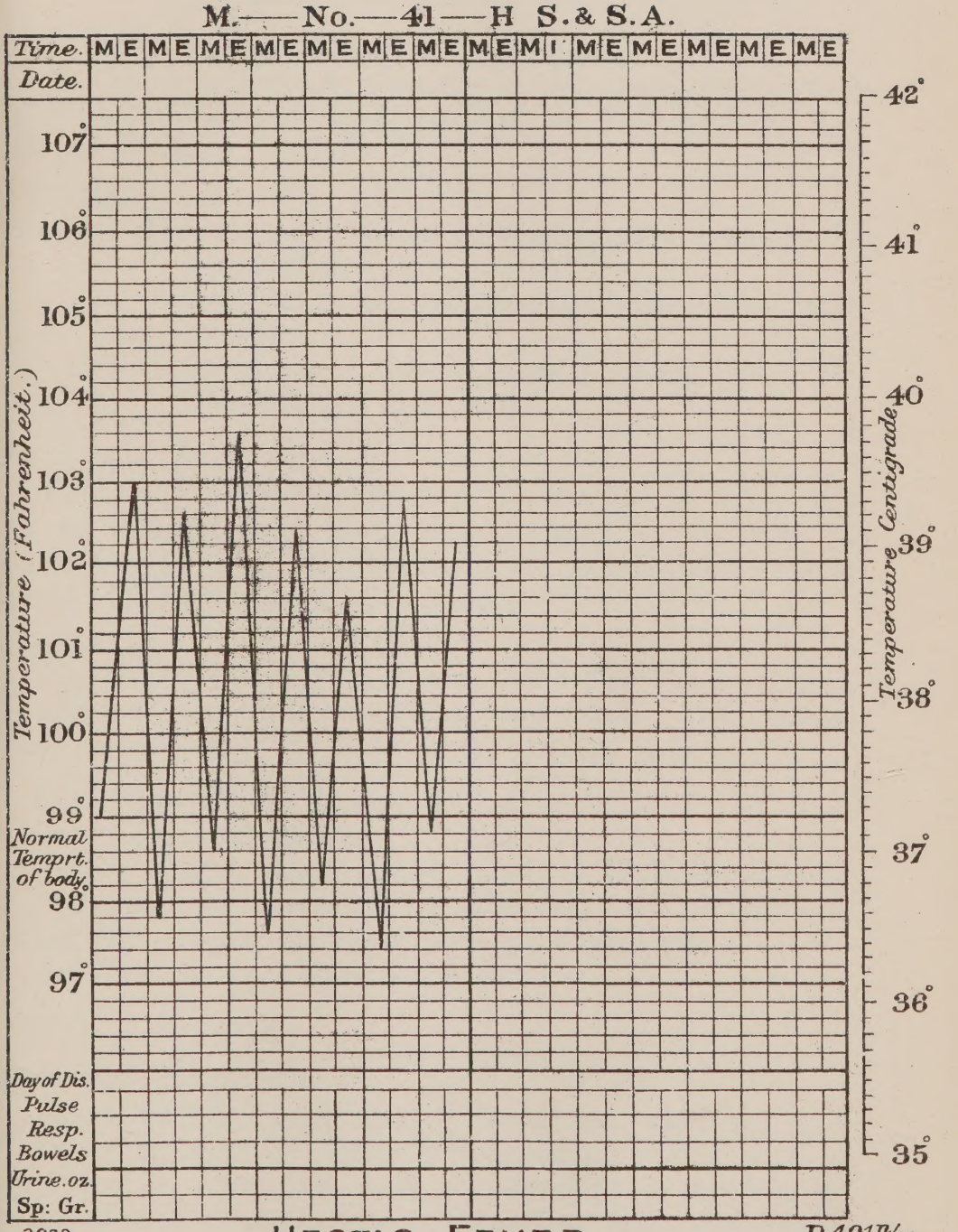
In some cases, instead of attempting to diminish the congestion, means are taken to increase the amount of blood in the part, so that there shall be more white blood corpuscles to attack the bacteria. This may be brought about in two ways.

(1) By obstructing the return of the blood through the veins. An elastic bandage is applied round the limb some distance above the inflammation. When properly applied, the limb will become swollen and a bluish-red in colour, but will not become cold nor painful, and the pulse will be unaltered. The bandage is kept on for about 20 hours each day, and during the remaining 4 hours the part is elevated to get rid of the impure blood. This method is only applicable to the limbs, and is known as Bier's treatment.

(2) By stimulating the flow of arterial blood.

- (*a*) By the application of heat, such as fomentations and poultices.
- (*b*) By the application of counter-irritants, such as mustard, iodine, cantharides.
- (*c*) By cupping.

This is described under General Nursing.


M.—No.—41—H S.& S.A.
Time.
Date.
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107°
106°
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Normal Temprt. of body.
98°
97°
Temperature (Fahrenheit.)
42°
41°
40°
39°
38°
37°
36°
35°
Temperature Centigrade
Day of Dis.
Pulse
Resp.
Bowels
Urine. oz.
Sp: Gr.
3933
HECTIC FEVER.
D 491n/08,
Malby & Sons, Lith.

Fig 75.

B. General.

An attempt is made to get rid of the toxins by purgatives. A low but nourishing diet and rest in bed are ordered. Later, tonics and good feeding are required.

CHRONIC INFLAMMATION.

In this condition the changes in the tissues take place much more slowly, and, except in Tuberculosis, an abscess is never formed.

Causes.

(1) The long-continued irritation of poisons, such as Alcohol.
(2) Certain bacteria, such as in Tuberculosis and Syphilis.
(3) Some diseases of unknown cause, such as Rheumatism and Gout.

Signs and Symptoms.

These are much the same as in the acute form but not so marked; and there may be no pain nor rise of temperature. The swelling is often permanent and is due to the formation of new tissue.

Treatment.

The cause is removed or treated. For the swelling, massage and counter-irritants are used. Of these, Scott's dressing is one of the most useful.

SUPPURATION means the formation of pus, and is always due to bacteria.

If the suppuration occurs within a definite circumscribed space it is called an **Abscess,** but if diffused among the cellular tissues it is called **Cellulitis.**

An Abscess may be acute or chronic.

ACUTE ABSCESS.

Signs and Symptoms.

There will be pain, heat, redness, and swelling, and all the symptoms of acute inflammation. The pain is throbbing in character, and the swelling is tender on pressure. By pressing on the swelling with one finger of each hand alternately, a wave—called *fluctuation*—can

be detected. In time the abscess may make its way to the surface of the skin or mucous membrane and is then said to "point." The skin becomes thin and the abscess may burst through this weak spot.

If suppuration occurs within one of the cavities of the body it is difficult to detect, and hectic fever may be the only sign.

Another method of demonstrating suppuration is by doing a "blood count." The number of white corpuscles in a definite quantity of blood is counted under the microscope. If the white corpuscles are much more numerous than in normal blood we know that suppuration is taking place somewhere in the body.

The symptoms of Sapræmia will be more or less marked.

In CELLULITIS there is a dusky, boggy, and tender swelling of the skin, having no definite margin. The constitutional symptoms are often very severe, and death may occur within a few days or even hours.

Treatment.

(1) Relieve the pain by fomentations.

(2) When it is decided that pus is present, the abscess is at once opened. If superficial, this does not cause much pain; but if deep, a local or general anæsthetic will be required. A knife with a sharply-curved blade, called Syme's knife, is sometimes used.

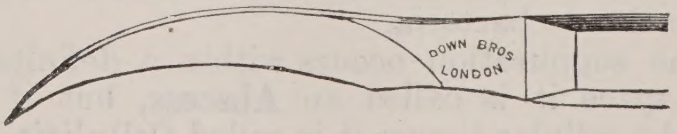

Fig. 76.
Syme's Knife.

(3) Keep the wound open by means of a drainage tube or strip of gauze, so that the pus may easily escape.

(4) The wound is dressed twice daily or oftener.

CHRONIC ABSCESS.

This is nearly always caused by the Tubercle Bacillus. The chief sign is swelling, and the treatment consists

either in drawing off the pus with an aspirator or in opening the abscess and then scraping away the abscess wall with a Volkmann's spoon.

As the result of imperfect healing of an abscess a sinus or a fistula may form.

A SINUS is a narrow track open at one end only, and leading from the site of an abscess to the surface of the skin or mucous membrane.

A FISTULA is a narrow track open at both ends, and leading either from one hollow organ to another, or from a hollow organ on to the surface of the skin or mucous membrane. For example, a track may lead from the bladder to the rectum or from the rectum on to the skin.

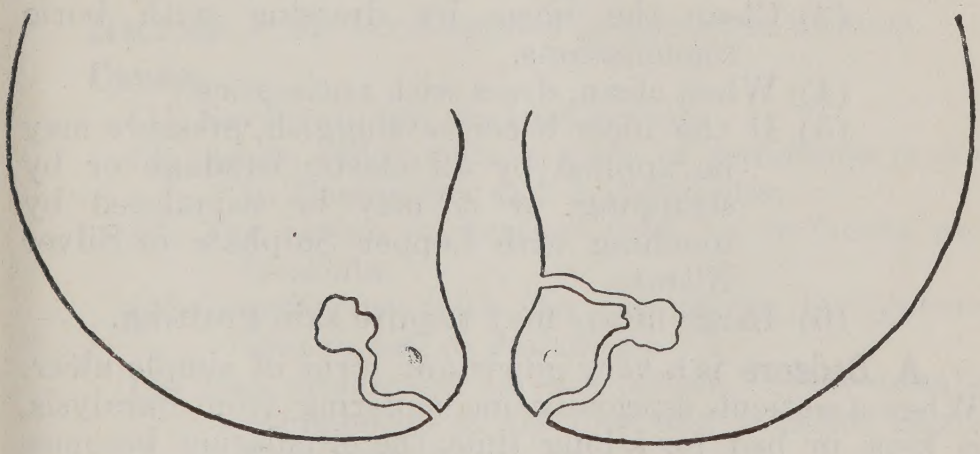

Fig. 77.
Sinus and Fistula.

Treatment of these conditions consists in slitting up the track, scraping its interior with a sharp spoon, and packing it firmly with gauze, so that the wound heals from the bottom.

ULCERATION.

An ulcer is formed on the surface of the skin or mucous membrane by the gradual loss of tissue which has been inflamed. Ulcers may be classed into three groups :—

1. **Simple Ulcers,** caused by the germs of suppuration or by injury.

2. Specific Ulcers, which occur in Syphilis and Tuberculosis.

3. Malignant Ulcers, which occur in Cancer.

1. Simple Ulcers.

Causes.

(*a*) The germs of suppuration.
(*b*) Mechanical injury.
(*c*) Imperfect circulation.
(*d*) The action of chemicals.
(*e*) The action of heat.
(*f*) The action of electricity, especially X-rays.

Treatment.

(1) Keep the part at rest.
(2) Elevate the part.
(3) Clean the ulcer by dressing with boric fomentations.
(4) When clean, dress with antiseptics.
(5) If the ulcer becomes sluggish, pressure may be applied by an elastic bandage or by strapping, or it may be stimulated by touching with Copper Sulphate or Silver Nitrate.
(6) Large ulcers may require skin grafting.

A Bedsore is a very important form of simple ulcer. When a patient, especially one suffering from Paralysis, is kept in bed for a long time, the circulation becomes imperfect in those parts which are most subjected to pressure, such as the buttocks, heels, and shoulders. A patch of skin becomes red and then dusky in colour; it dies and comes away in the form of a black slough, and an ulcer remains.

The method of preventing bedsores is described on page 227.

2. Specific Ulcers.

Syphilitic Ulcers occur in the tertiary stage, usually on the legs, and are dealt with under Syphilis.

Tuberculous Ulcers are generally the result of an abscess. One form, called **Lupus,** occurs on the nose or cheeks, and is treated by X-rays or the Finsen light.

3. Malignant Ulcers.

These may occur in practically any part of the body. They are usually painful and often bleed readily. The patient loses flesh and becomes anæmic.

Treatment.

When possible, the malignant ulcer, together with a considerable amount of the surrounding tissues, is removed by operation.

GANGRENE.

Gangrene means the death of tissues in masses, not cell by cell as in ulceration. The dead part is called a **slough.**

Sloughing is the term applied to gangrene of soft tissues.

Necrosis is the term applied to gangrene of bone.

Causes.

(1) Severe injury, such as a crush.
(2) Acute inflammation, such as sometimes occurs in Pneumonia and Appendicitis.
(3) The action of heat or cold, as in burns and frostbite.
(4) Interference with the circulation, by ligature, tourniquet, or embolism.
(5) Bad circulation in old people. This usually commences in the toes, and is called **Senile Gangrene.**
(6) Diabetes. This commences on the foot and is called **Diabetic Gangrene.**

Appearances.

In some forms of Gangrene the part is black, dry and shrivelled, and may in time drop off; in others, the part is swollen, soft, and moist, greenish-black in colour, and soon becomes septic.

Treatment.

Cleanliness, warmth, and dryness are the three points to keep in view. Dusting powders, dry dressings, and much cotton wool are the usual requisites. Amputation of a limb may be necessary.

Chapter V

HÆMORRHAGE.

Hæmorrhage means the escape of circulating blood from the heart or blood vessels.

Causes.

(*a*) **Injury,** as in wounds of all kinds.

(*b*) **Disease,** as in aneurysm and ulceration.

Varieties.

(*a*) **Capillary Hæmorrhage,** where the blood escapes from the capillaries. The blood *oozes* from the whole surface of the wound, and is *brick-red* in colour. This is the least dangerous variety.

(*b*) **Venous Hæmorrhage,** where the blood escapes from the veins. The blood flows in a continuous stream from the end of the leaking vessel furthest from the heart. It *wells up* from the bottom of the wound, and is *dark red or purple* in colour. This is next in seriousness to arterial hæmorrhage.

Many people suffer from what are called **Varicose Veins.** In this condition the superficial veins, usually of the leg, become dilated and twisted, and may burst. As the veins become dilated the valves cease to act, so that when hæmorrhage occurs the blood will flow from both ends of the vessel, and death may speedily occur.

(*c*) **Arterial Hæmorrhage,** where the blood escapes from the arteries. The blood *spurts* from the end of the artery nearest the heart, in jets which correspond in time with the beat of the heart, and is *bright scarlet* in colour. This is the most dangerous variety.

Situation.

(*a*) **External Hæmorrhage** is where the blood escapes on to the surface of the body, and is usually the result of injury. Blood will be seen, and in mild

cases no other signs may occur; but if the hæmorrhage be severe the patient will show all the symptoms of syncope and shock.

(*b*) **Internal Hæmorrhage** is where the blood escapes into one of the cavities of the body, and may be the result of injury or disease.

Blood may not be seen at all, or may appear later from any orifice of the body.

The most serious forms of Internal Hæmorrhage occur in cases of ruptured aneurysm, and where the liver and spleen are injured.

Special Forms of Internal Hæmorrhage.

(1) **Hæmoptysis** or coughing up of blood from the lungs. This may occur in cases of Phthisis, Pneumonia, or in wounds of the Lung. The blood is frothy, and usually bright red in colour.

(2) **Hæmatemesis** or the vomiting of blood from the stomach. This occurs chiefly in cases of Cancer of the Stomach and Gastric Ulcer. The blood is usually intimately mixed with the contents of the stomach. If it has been in the stomach for some time the blood becomes dark brown in colour, and resembles coffee grounds.

(3) **Epistaxis** or the escape of blood from the nose. This is usually due to injury, but may occur in cases of Nephritis, Heart Disease and Enteric Fever.

(4) **Hæmaturia** or the presence of blood in the urine. This may be due to injury or disease of the Kidneys, Ureters, Bladder, or Urethra.

(5) **Melæna** or the passage of dark coloured blood from the rectum. This is generally due to hæmorrhage into the Stomach, the blood being altered during its passage through the Intestines so that it escapes as a thick, black, tarry-looking substance.

Signs of Internal Hæmorrhage.

The skin becomes pale, cold and moist; the pulse feeble and rapid; the respirations shallow and sighing; the pupils dilated; and the temperature falls to below normal. The patient is restless, complains of thirst, and at last becomes unconscious.

(*c*) **Subcutaneous Hæmorrhage** is where the blood escapes into the tissues under the skin. This is also called **Extravasation of Blood.** If the blood collects in a definite space a **Hæmatoma** or blood tumour forms.

FIRST-AID TREATMENT OF HÆMORRHAGE.

1. EXTERNAL HÆMORRHAGE.

A.—Capillary Hæmorrhage.

Expose the part to the air, and apply pressure *directly to the wound* by means of a clean finger or clean piece of dressing. If this is not sufficient, a **Styptic** (substance which checks bleeding) may be applied. The chief styptics are :—

Very hot or very cold water, common salt, alum, tincture of the perchloride of iron, Friar's balsam, tannic acid, and turpentine.

These styptics are very seldom required, and *great care should be exercised in using them*, as death of the tissues may subsequently occur.

B.—Venous Hæmorrhage.

(1) Lay the patient down, and expose the wound so that you can see exactly what you are doing.

(2) Remove all constrictions which may interfere with the circulation, such as tight clothing round the neck, garters, suspenders, rolled up trousers, &c.

(3) Elevate the part above the level of the heart if possible.

(4) Apply digital pressure *directly to the bleeding point*, and then substitute for the finger a clean pad and bandage.

(5) Keep the part elevated and at rest for some time afterwards.

Ruptured Varicose Veins are treated in the same way.

C.—Arterial Hæmorrhage.

(1) Lay the patient down and expose the wound.
(2) Remove all constrictions.
(3) Keep the patient absolutely quiet.

Further treatment will depend upon the severity of the hæmorrhage.

(*a*) *If the bleeding is not excessive*, as in hæmorrhage from an artery in the head or in the limbs below the elbow and knee,

(1) Apply digital pressure directly over the bleeding point.

(2) When the bleeding has ceased apply a pad over the wound and fix with a *firm* bandage.

(*b*) *If the bleeding is excessive*, as in cases of hæmorrhage from an artery in the neck or in the limbs above the elbow and knee,

(1) Apply digital pressure to the main artery of the part at a point between the wound and the heart.

(2) Maintain this pressure until help arrives, or until a tourniquet is applied.

Method of applying Digital Pressure.

(1) Find the position of the artery and feel for its pulsation.

(2) Press the artery against bone, and not against soft tissues such as muscle.

(3) Compress the artery with the thumb whenever possible.

(4) Compress the artery at the nearest compressible point above the wound.

ARTERIES WHICH CAN BE COMPRESSED.

Name of Artery.	Line of Artery.	Point at which Compressed.	Remarks.
TEMPORAL	Runs upwards in front of the ear to supply the side of the head.	One finger's breadth in front of the ear.	
OCCIPITAL	Runs upwards behind the ear to supply the back of the head.	Two fingers' breadth from the centre of the back of the ear.	
FACIAL -	Runs upwards from the neck across the lower jaw to supply the face.	1 inch in front of the angle of the jaw.	
COMMON CAROTID.	With the head turned to the opposite side, draw a line from the sterno-clavicular joint to a point midway between the angle of jaw and the mastoid process.	1½ inches above the sterno-clavicular joint.	Do not press against the trachea, but against the cervical vertebræ.
SUBCLAVIAN.	Runs outwards between the clavicle and the first rib.	Behind the centre of the clavicle.	Press downwards against the first rib.
AXILLARY	Runs outwards from behind the clavicle to the outer side of the axilla.	At the junction of the outer with the middle third of the axilla.	
BRACHIAL	Runs down the inner side of the arm from the axilla to a point 1 inch below the bend of the elbow.	The centre of the arm.	Compress with the fingers. Grasp the arm from behind and below, using your right hand for the patient's left brachial, and *vice versâ*.
RADIAL -	Runs from a point 1 inch below the bend of the elbow to the radial side of the front of the wrist.	1 inch above the wrist.	These arteries must be compressed together, using one thumb for each.
ULNAR -	Runs from a point 1 inch below the bend of the elbow to the ulnar side of the front of the wrist.	1 inch above the wrist.	

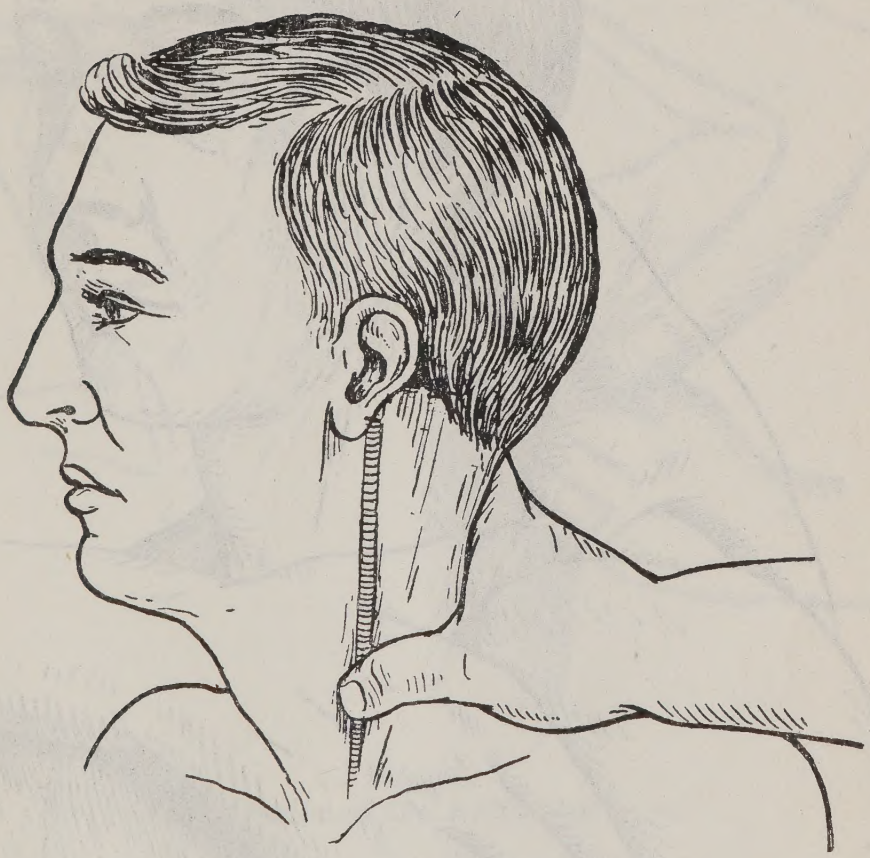

Fig. 78.

Compression of the Carotid Artery.

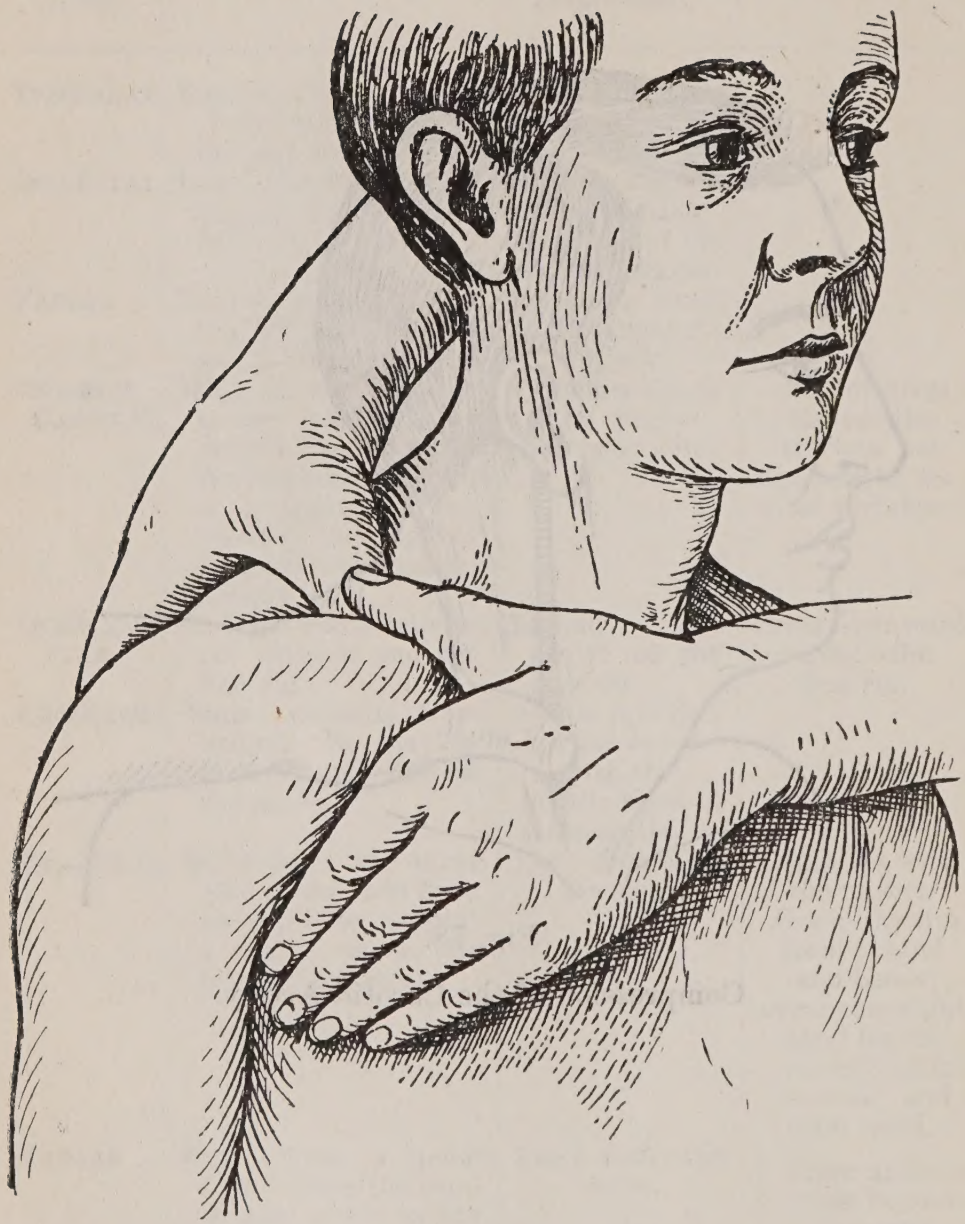

Fig. 79.

Compression of the Subclavian Artery.

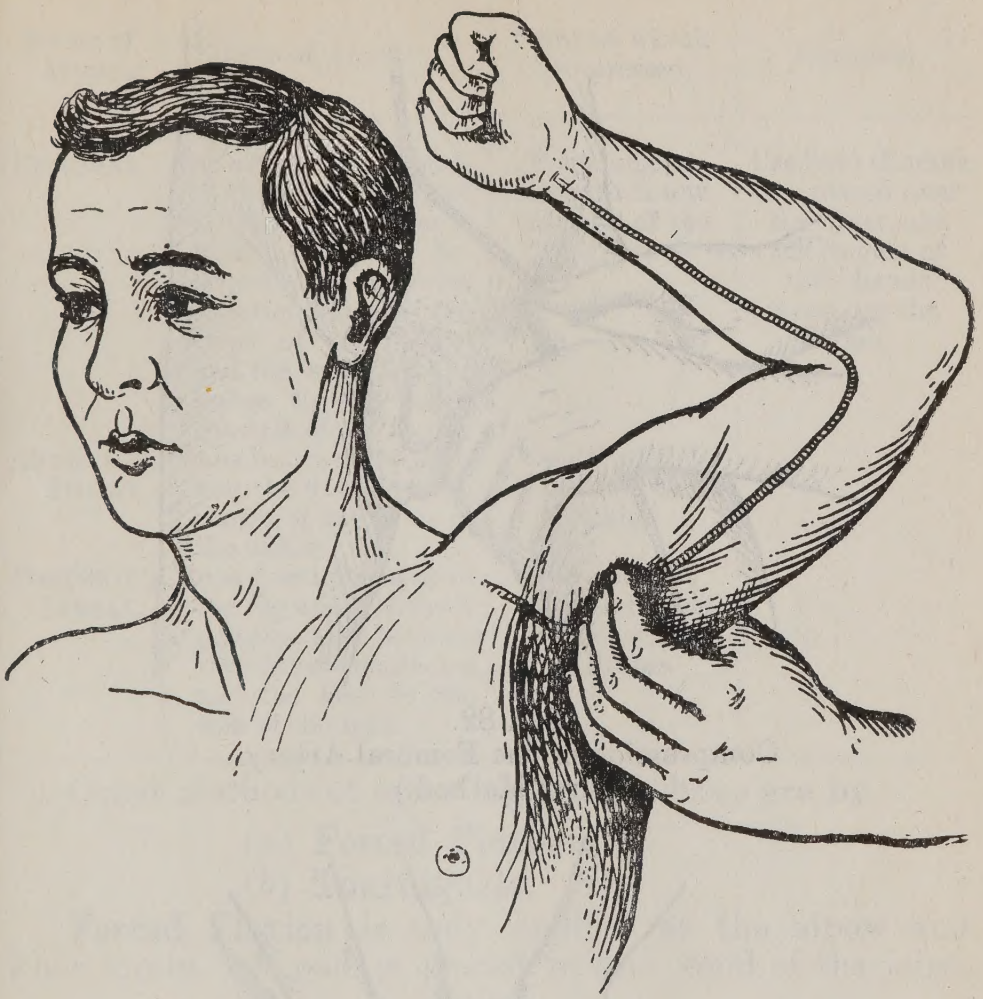

Fig. 80.
Compression of the Axillary Artery.

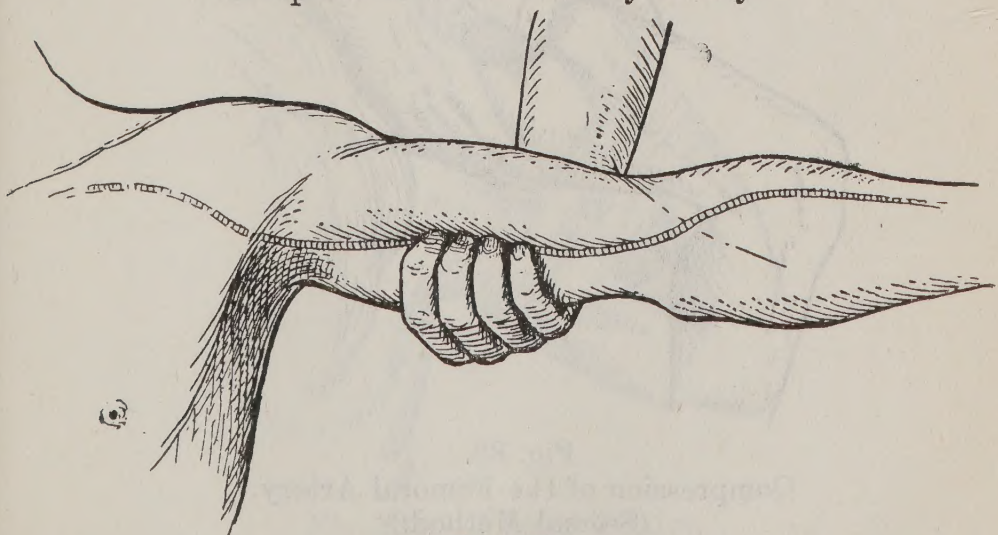

Fig. 81.
Compression of the Brachial Artery.

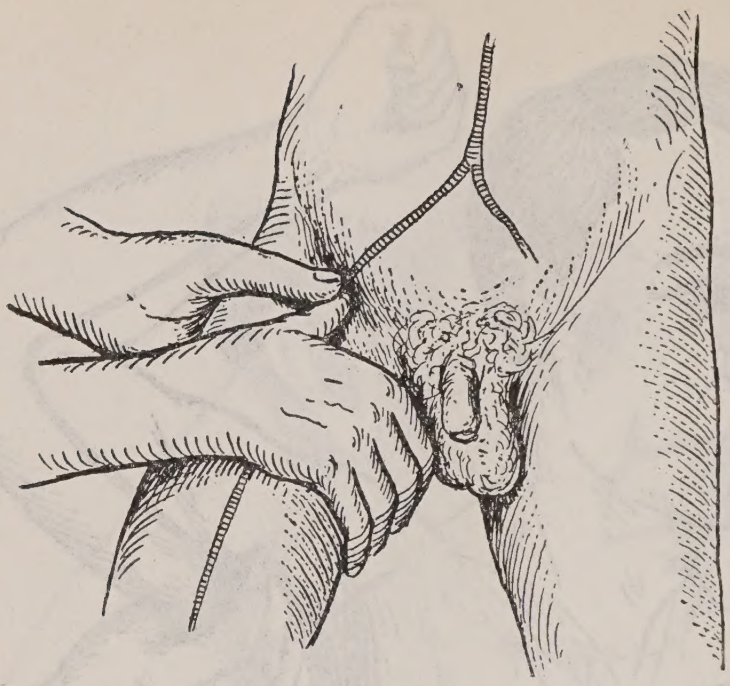

Fig. 82.
Compression of the Femoral Artery.
(First Method.)

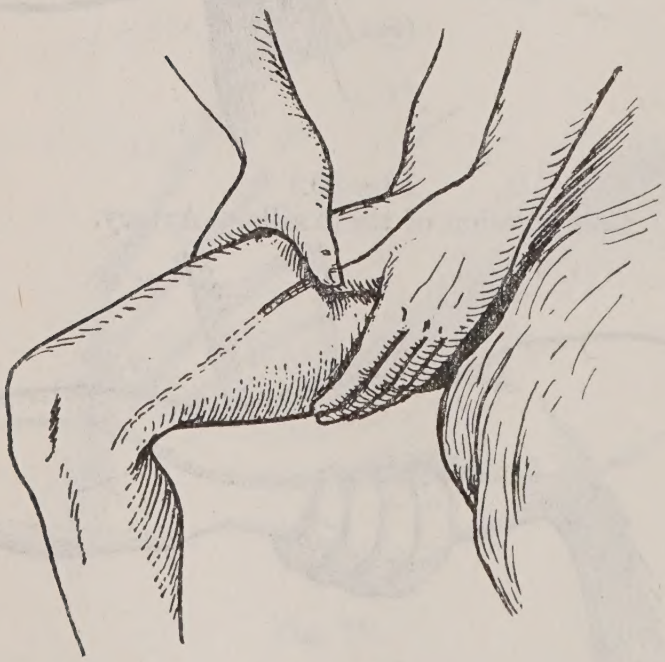

Fig. 83.
Compression of the Femoral Artery.
(Second Method.)

Name of Artery.	Line of Artery.	Point at which Compressed.	Remarks.
FEMORAL	The artery corresponds to the upper third of a line drawn from a point midway between the anterior superior spine of the crest of the ilium and the spine of the pubes to the inner condyle of the knee.	Four fingers' breadth below the fold of the groin.	Use both thumbs, one placed over the other, and the fingers of both hands grasping the thigh.
ANTERIOR TIBIAL.	Runs between the tibia and the fibula to the centre of the front of the ankle.	Centre of the front of the ankle.	
POSTERIOR TIBIAL.	Runs down the back of the leg under the calf muscles, then between the inner malleolus and the heel to the sole of the foot.	One thumb's breadth behind the internal malleolus.	

Other methods of arresting hæmorrhage are by

(*a*) **Forced Flexion.**

(*b*) **Tourniquets.**

Forced Flexion is only applied at the elbow and knee joints. A pad is placed in the bend of the joint,

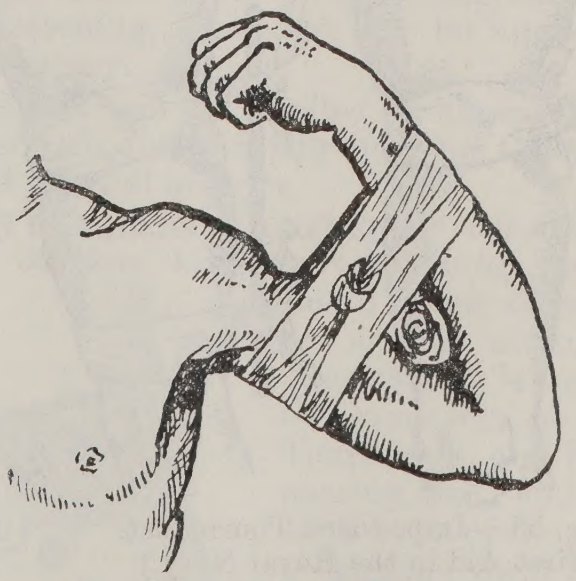

Fig. 84A.—Forced Flexion.
(First Aid in the Royal Navy.)

the limb is forcibly flexed, and fixed in this position by means of a bandage. This is a very painful method.

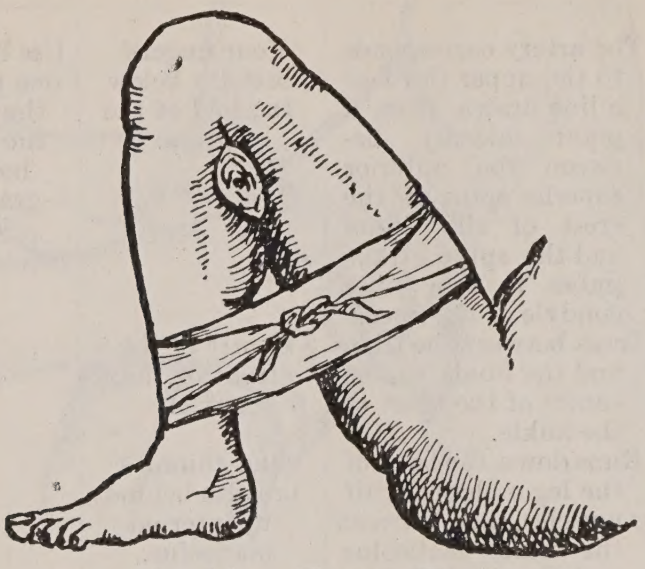

Fig. 84B.—Forced Flexion.
(First Aid in the Royal Navy.)

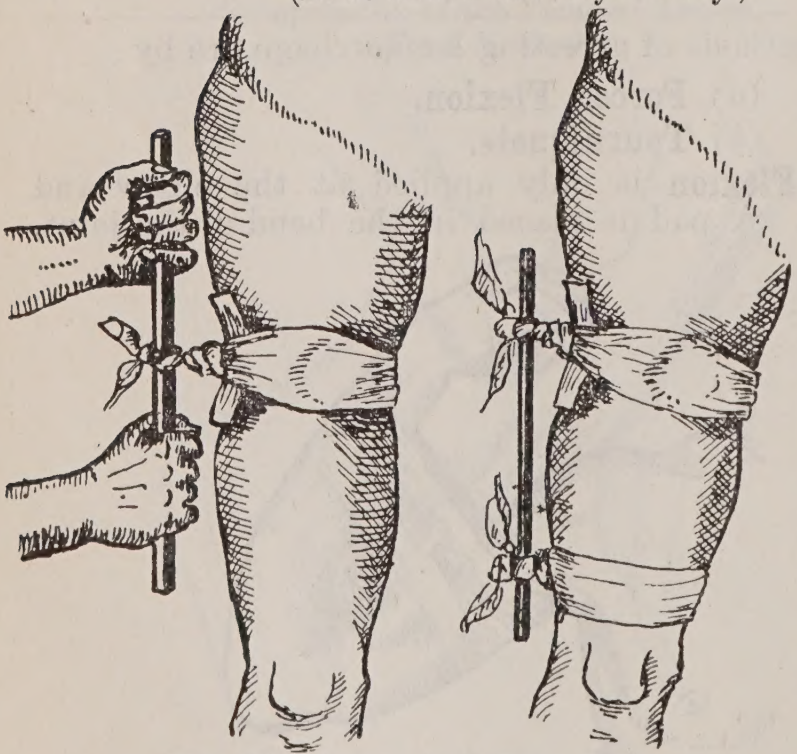

Fig. 85.—Improvised Tourniquet.
(First Aid in the Royal Navy.)

A Tourniquet is an instrument used for compressing blood vessels, and is only applied to the limbs. The various kinds of tourniquets are: (1) **Improvised.**—Some hard substance, such as a cork or stone, is folded in the centre of a narrow-fold triangular bandage or handkerchief, and is placed over

the artery. The bandage is tied with a single knot round the limb, and a piece of stick is then placed on the knot and a reef knot tied over it. On twisting the stick the bandage will constrict the blood vessels in the limb. One end of the stick must be secured by means of another bandage.

(2) **Elastic.**—In the Navy two kinds of elastic tourniquets are supplied.

(*a*) **Foulis' Tourniquet** consists of a round india-rubber cord threaded through a hole in a flattened ebonite block. The cord is stretched and wound *at least twice* round the limb and the end slipped into the notch in the block.

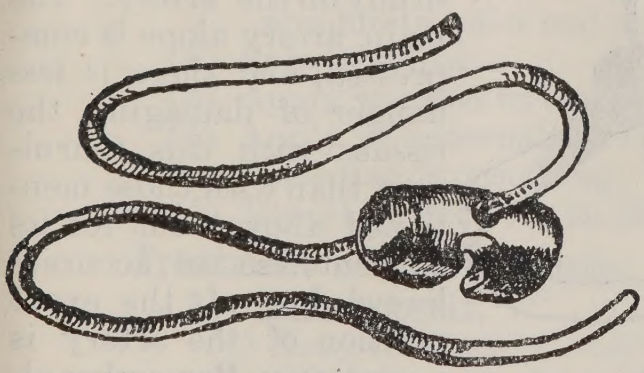

Fig. 86.—Foulis' Tourniquet.
(First Aid in the Royal Navy.)

The following points should be observed in applying this tourniquet:—

(1) The india-rubber must be kept on the stretch while being applied.

(2) The ebonite block is intended only as a fastening, and need not be applied over the artery.

(3) It can be applied at almost any part of a limb, but is chiefly used for the brachial and femoral arteries.

(*b*) **Samway's Anchor Tourniquet** consists of a piece of stout india-rubber tubing having a metal catch shaped like an anchor attached to one end. It is applied in the same way as Foulis' Tourniquet, and fixed by passing the end below each fluke of the anchor.

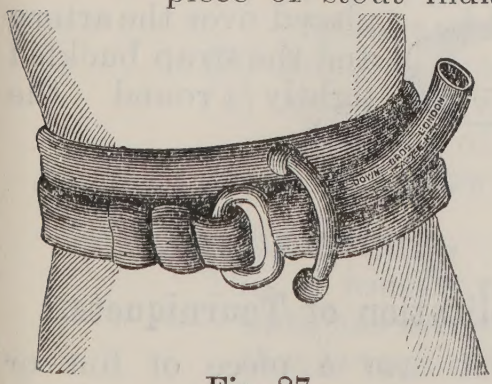

Fig. 87.
Samway's Anchor Tourniquet.

Another form is made, fitted with a short chain at one end and a hook at the other, and is fixed

by passing one link of the chain over the hook.

(3) **Screw or Petit's Tourniquet.**—This consists primarily of a piece of webbing strap, a pad, and a screw. The pad is placed directly over the artery, and the webbing strap buckled round the limb. On tightening up the screw the pad is pressed firmly on the artery. The main artery alone is compressed, and there is less danger of damaging the tissues with this tourniquet than with those mentioned above; but for its efficient use an accurate knowledge of the exact position of the artery is necessary. Remember always to unscrew it as far as possible before applying, so that the sliding brass piece is in contact with the fixed part near the pad.

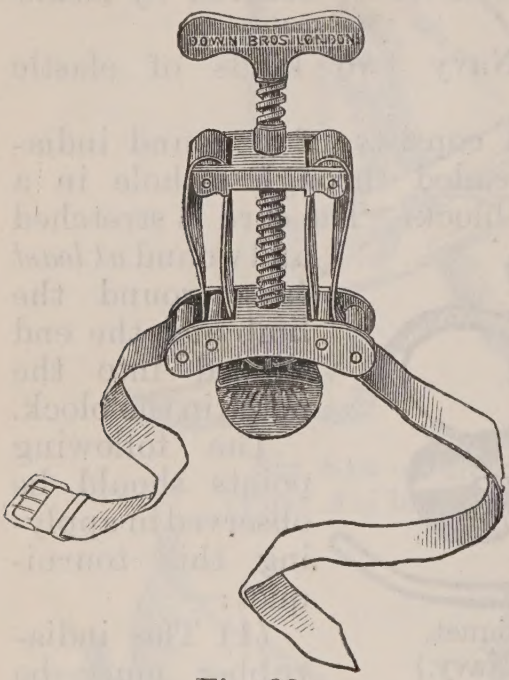

Fig. 88.
Petit's Screw Tourniquet.

(4) **Field Tourniquet.**—This is supplied in the No. 2 Field Chest, and consists of a webbing strap attached to a pad by means of a spring. The pad is placed over the artery and the strap buckled tightly round the limb.

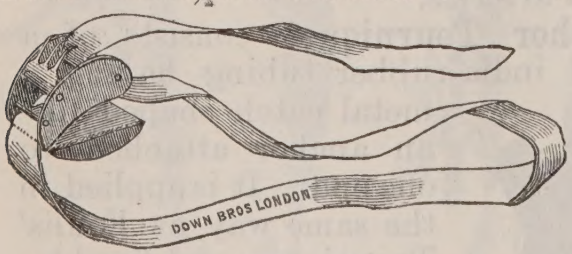

Fig. 89.
Field Tourniquet.

General Rules for the application of Tourniquets.

(1) Apply the tourniquet over a piece of lint or bandage.

(2) Do not exert more pressure than is just sufficient to stop the bleeding.

(3) After the tourniquet has been on for one hour, loosen it gently and slowly, and be prepared to tighten it again should the bleeding commence. *Never keep a tourniquet applied for more than three hours*, or gangrene of the limb may occur.

2. INTERNAL HÆMORRHAGE.

General Treatment.

(1) Lay the patient down and keep him absolutely quiet and at rest.
(2) Raise the feet.
(3) Apply warmth to the extremities.
(4) Apply ice externally over the part where the bleeding is occurring.
(5) Report at once to the Medical Officer.

Treatment of Special Cases.

A.—Hæmoptysis.

(1) Keep the patient absolutely at rest in bed.
(2) Slightly raise the head and shoulders, and turn the head to one side.
(3) Allow a good supply of fresh air.
(4) Apply ice to the chest and give ice to suck.

B.—Hæmatemesis.

Treat as above, but apply the ice to the stomach.

C.—Epistaxis.

(1) Undo all tight clothing.
(2) Seat the patient in a chair with his arms raised and his head erect.
(3) Admit as much fresh air as possible.
(4) Apply cold water or ice to the nose and to the back of the neck.
(5) Do not allow the patient to blow his nose.

D.—Hæmaturia.

This is usually not alarming, and rest in bed until the arrival of the Medical Officer is all that is required.

E.—Melæna.

Here again, rest alone is all that can be done. Melæna must not be confounded with recent hæmorrhage from the bowel, such as occurs in Enteric Fever, which will be dealt with under that heading.

SURGICAL TREATMENT OF HÆMORRHAGE.

Whenever possible, the bleeding vessel is picked up and compressed with a pair of Spencer Well's artery forceps, even if an operation has to be performed to reach that vessel, as in some cases of Internal Hæmorrhage. If the vessel is very small it is twisted by means of the forceps, which are then removed. In other cases the vessel is tied, or *ligatured*, and the forceps then removed. The materials used for tying blood vessels are called *ligatures*, the chief of which are :—

(1) Catgut.
(2) Silk.
(3) Kangaroo Tendon.

Ligatures should be 1 foot in length and should be very carefully sterilised.

When the actual bleeding point cannot be reached, as in some cases of Internal Hæmorrhage, drugs which aid the coagulation of blood are employed. These drugs are called *Hæmostatics* and are usually injected by means of a hypodermic syringe. The most commonly used hæmostatics are :—

(1) Opium and Morphia.
(2) Ergot and Ergotine.
(3) Adrenalin.

In cases of severe hæmorrhage, the circulation can be maintained by introducing a quantity of a solution of salt into the system.

The solution is made by adding 1 teaspoonful of common salt, or 2 tablets of sodium chloride compound, to a pint of water. This is sterilised by boiling, and then cooled to a temperature of 105° F. by standing the receptacle in cold water. Cold water must not be added to the sterilised solution.

This saline solution may be introduced into the body in various ways :—

(*a*) **Into a vein.**—A bandage or lightly applied tourniquet is fixed round the upper arm to make the veins prominent. The largest vein in the front of the bend of the elbow is opened, and a small metal cannula, connected by a piece of rubber tubing to a glass funnel, is inserted into the vein. The whole apparatus must be carefully sterilised. The cannula, tube, and funnel must be filled with the saline solution before the cannula is introduced, because death might occur should any air get into the vein. This apparatus is supplied in the Service Afloat Instrument Chest in an oval japanned tin case. 4 pints of solution should be prepared.

(*b*) **Into the subcutaneous tissues.**—The solution is introduced into the loose cellular tissue under the skin of the breasts, axillæ, or flanks. The above apparatus may be used, except that a sharp hollow needle is substituted for the cannula. Another method is to tie the needle into a sterilised Higginson's syringe in place of the usual nozzle, and pump the fluid into the tissues.

(*c*) **Into the rectum.**—A tube and funnel are required and the solution is run into the rectum *very slowly*, otherwise it will act as an enema and be returned. The funnel should be held only a few inches above the level of the anus.

(*d*) **Into the peritoneal cavity.**—This method is used only after abdominal operations. From 2 to 4 pints of the saline solution are poured into the abdominal cavity before the wound is closed.

Saline infusion is also largely used in the treatment of Shock.

Another classification of hæmorrhage is according to the time at which it occurs. There are three classes :—

(1) PRIMARY HÆMORRHAGE is that which occurs immediately after the injury and is the commonest form.

(2) Reactionary Hæmorrhage occurs within 24 hours after the injury.

After a severe injury or operation the patient suffers from Shock. His heart is beating feebly, so that blood-clots easily form in the ends of the cut arteries, and the primary hæmorrhage ceases. He is put to bed and recovers from the Shock, the heart beats more strongly, and these blood-clots may be forced from the cut ends of the arteries and reactionary hæmorrhage then occurs. Reactionary hæmorrhage may also be due to the slipping of a ligature.

Signs.

If the hæmorrhage occurs in a wound involving the skin the blood will gradually soak through the dressings and can be seen. If the hæmorrhage occurs in some cavity of the body the patient will show the signs of Internal Hæmorrhage.

Treatment.

(1) Inform the Medical Officer.
(2) *Do not remove the dressings.*
(3) Apply sterilised wool and a bandage over the whole of the original dressings.
(4) Apply the general treatment mentioned under Internal Hæmorrhage.

(3) Secondary Hæmorrhage occurs after 24 hours from the time of the injury, and is always due to the wound becoming septic.

Chapter VI.

WOUNDS.

A Wound is a break in the surface of the skin or mucous membrane, caused by violence.

A Contusion, or bruise, is the laceration of the soft subcutaneous tissues without a break in the overlying skin or mucous membrane.

Signs.

The part is more or less swollen, and becomes blue or black in colour. A day or two later the colour changes to violet, then green, and lastly yellow. These colours are due to changes in the blood which has escaped into the tissues.

In some cases the hæmorrhage is so free as to produce a distinct tumour called a **Hæmatoma.**

Treatment.

Rest and the application of cold

THE HEALING OF WOUNDS.

1. By First Intention or Primary Union.

When the edges of an aseptic wound are kept together, new branches form on the ends of the cut capillaries and join with similar branches from the opposite side. Around these capillaries new cells are formed until the two sides are again firmly united. At the same time, the epidermis grows inwards from the edges of the wound and covers the new tissue, which in time becomes fibrous and results in a permanent white scar. Wounds heal by first intention in from 3 to 10 days.

Conditions which prevent healing by First Intention.

(*a*) Sepsis.

(*b*) The edges of the wound not being in apposition.

(*c*) Separation of the cut surfaces by a large amount of serum.

(*d*) Lack of rest.

2. By Second Intention or Granulation.

When the edges of a wound gape, small rounded pink projections, called **granulations,** form on the cut surfaces. These granulations consist of new branches from the cut capillaries, and of new cells. These multiply until the cavity is completely filled, when the epidermis grows inwards from the edges and covers the new tissue. The scar thus formed contracts, and becomes depressed owing to the formation of fibrous tissue. It will be seen that the process is really the same in each of these methods of healing, the only difference being in the quantity of new tissue required.

The time taken by wounds to heal by second intention varies according to the amount of new tissue required, and may be many weeks.

The Antiseptic Treatment of Wounds.

By this is meant the prevention of the growth and development of germs in wounds. The present mode of treatment is partly aseptic and partly antiseptic.

All instruments, dressings, &c. are sterilised by heat—that is, they are made aseptic; while the wound itself, the surrounding skin, and the dresser's hands are sterilised as far as possible by the action of chemical antiseptics.

An account of the most important antiseptics is given in the following table :—

Antiseptics in Common Use.

Name.	Strength of Solution.	How recognised.	Uses.	Advantages.	Disadvantages.
Carbolic Acid (Phenol).	(*a*) 1 in 20. (*b*) 1 in 40.	By the smell. Usually coloured red.	(*a*) For instruments; to clean the skin and foul wounds. (*b*) For dressings and compresses.	(1) It is a powerful antiseptic. (2) It does not injure metal instruments. (3) It acts well on greasy skin.	(1) It is poisonous. (2) It may be absorbed and cause poisoning. (3) It irritates and roughens the skin.
Perchloride of Mercury (Corrosive Sublimate).	From 1 in 500 to 1 in 5,000.	Usually coloured blue.	To clean the skin and for dressings and compresses.	(1) It is a very powerful antiseptic. (2) It does not irritate the skin. (3) It is easily carried in the form of tablets, a very small number of which make a large quantity of lotion.	(1) It is poisonous. (2) It may be absorbed and cause poisoning. (3) It corrodes metal instruments.
Lister's Strong Solution.	1 in 20 carbolic; 1 in 500 perchloride.	By the smell of carbolic and the blue colour.	To clean the skin and foul wounds.	It has the advantages of both constituents.	It has the disadvantages of both constituents.
Biniodide of Mercury.	1 in 500, usually made with 70 per cent. of spirit.	By the smell of spirit. Usually coloured blue.	To clean the skin.	(1) It is a very powerful antiseptic. (2) It does not injure metal instruments, except after long contact. (3) It penetrates the skin. (4) It does not irritate the skin if made without spirit.	It is poisonous.

Antiseptics in Common Use—*continued.*

Name.	Strength of Solution.	How recognised.	Uses.	Advantages.	Disadvantages.
Boric Acid (Boracic Acid).	A saturated solution; about 1 in 25.	(It is colourless, tasteless, and odourless.)	To irrigate the eyes and mucous cavities. For dressings and compresses. For instruments which will come in contact with the eye or mucous membranes.	(1) It is not poisonous. (2) It is not irritating.	It is a very mild antiseptic.
Potassium Permanganate.	From 1 in 100 to 1 in 5,000.	By its purple colour.	To irrigate the urethra and bladder. To irrigate wounds. As a mouth wash. In snake bites.	(1) It is not poisonous. (2) It is not irritating, except in very strong solution. (3) It is a good deodorant.	It stains the skin and mucous membrane.
Hydrogen Peroxide.	Supplied in 10 volume and 20 volume strengths.	- - -	To irrigate septic wounds and cavities. As a mouth wash.	(1) It is not poisonous. (2) It is not irritating.	
Iodoform -	Never used in solution.	By the smell and yellow colour.	As a dusting powder for ulcers. For packing cavities, in the form of iodoform gauze. For injecting into tuberculosis cavities in the form of an emulsion with glycerine.	- - - -	(1) It is a feeble antiseptic. (2) It has an objectionable smell. (3) It may be absorbed and cause poisoning.

In addition to these antiseptics, there are several proprietary preparations, most of which are allied to Carbolic Acid—such as Lysol, Lysoform, Cresol, Creolin, Izal, Listerine, Jey's Fluid, and the disinfectant fluid supplied to ships, which may be described as a Cresylic Acid Compound.

THE GENERAL TREATMENT OF WOUNDS.

1. Arrest the hæmorrhage.
2. Clean the wound and the surrounding skin.
3. Dress the wound.
4. Keep the part at rest.

1. The treatment of hæmorrhage has already been dealt with.

2. (*a*) Prepare, and have at hand, everything you may require. These are:—A razor, nail brush, ether soap, sterile water (hot and cold), spirit biniodide lotion, sterilised towels, swabs, gauze, lint, wool, bandages, and, except in the case of very small superficial wounds, sterilised rubber gloves.

(*b*) Thoroughly scrub your hands, using hot water, soap, and a nail brush. See that the finger nails are short and clean. Then scrub the hands in Biniodide of Mercury, Perchloride of Mercury, or Carbolic Lotion.

(*c*) Protect the wound with a swab or strip of gauze, and place a mackintosh and towels under and around the part.

(*d*) If the surrounding skin be very dirty, it must be scrubbed with soap and water, otherwise the brush may be omitted. Turpentine is very useful in removing grease and dirt such as is found in the case of men employed with machinery.

(*e*) Shave the skin for some distance around the wound. The distance will depend upon the size of the wound, but should never be less than 4 inches.

(*f*) Wash off the soap and loose hairs with sterile water.

(*g*) Wash your hands again, and put on sterilised gloves. Place clean sterilised towels under and around the part.

(*h*) Uncover the wound, and remove from it any dirt or other foreign body which may be present. Swab it, and the surrounding skin, with some antiseptic lotion.

The wound is now ready to be sutured (if necessary) and dressed.

3. **Dressings** include the following:—Gauze, lint, cotton wool, bandages, and protective tissue.

(1) **Gauze.**

(*a*) Plain white.
(*b*) Cyanide—mauve in colour; treated with Cyanide of Mercury and Zinc.
(*c*) Iodoform—yellow in colour; treated with Iodoform.

(2) **Lint.**

(*a*) Plain white.
(*b*) Boric—pink in colour; treated with Boric Acid.

(3) **Cotton Wool, absorbent.**

(*a*) Plain white.
(*b*) Sal Alembroth—blue in colour; treated with Ammonio-mercuric Chloride.

(4) **Bandages.**

(*a*) Calico.
(*b*) Cotton, woven.
(i) Plain white.
(ii) Sal Alembroth—blue in colour.
(iii) Cyanide of Mercury—mauve in colour.
(*c*) Gauze.
(*d*) Domette.
(*e*) Flannel.
(*f*) Esmarch's Triangular Bandage.

(5) **Protective Tissue.**

(*a*) Oiled paper.
(*b*) Oiled silk.
(*c*) Gutta percha tissue.
(*d*) Jaconet.
(*e*) Mostig battist.

Sterilisation of Dressings.

Before use, all the above dressings (except oiled paper, oiled silk, and gutta percha tissue) are sterilised by heat.

The gauze, lint, and wool are cut into suitable sizes, and then, with the bandages and jaconet, are packed into perforated metal boxes, which are placed in a steam steriliser, such as that described on page 295.

Dressings are used dry or wet; when wet, they are dipped in a weak antiseptic lotion (such as 1 in 40 carbolic, or 1 in 1,000 perchloride).

Collodion Dressings may be applied in three ways:—

(1) The collodion is painted directly on to the wound. This is a bad method as the collodion easily becomes detached.

(2) One or two layers of gauze are placed over the wound and the collodion painted on to the gauze.

(3) A narrow pad of several layers of gauze is laid on the wound. Over this a much larger single layer of gauze is placed, and fixed to the skin by painting with collodion. The collodion thus does not come in contact with the wound.

Method of Dressing a Clean Wound.

Unless you have special orders to the contrary, always carry out the following routine:—

(1) Place several layers of plain white sterilised gauze directly on the wound.

(2) Cover with white sterilised cotton wool.

(3) Secure with a woven cotton bandage.

(4) The part is kept at rest by slings or splints, or by keeping the patient in bed.

WOUNDS are divided into five groups:—Incised, Lacerated, Contused, Punctured, and Gunshot. They may be simple or poisoned.

I.—SIMPLE WOUNDS.

(A) INCISED WOUNDS are clean cut, and are produced by some sharp instrument. The best examples are those

made during a surgical operation, and in the case of suicidal cut throat.

Characteristics.

Hæmorrhage is free, and the wound gapes. They heal readily.

Treatment.

Proceed as described under General Treatment.

As these wounds gape, the edges must be brought together, otherwise they cannot heal by first intention. This may be done by placing narrow strips of adhesive plaster *at intervals* across the wound, or by sutures.

A Suture is a stitch, the materials used being silkworm gut, horse hair, silver wire, and, occasionally, cat gut and silk.

Surgical needles are made in three shapes:—

Straight. Half curved. Curved.

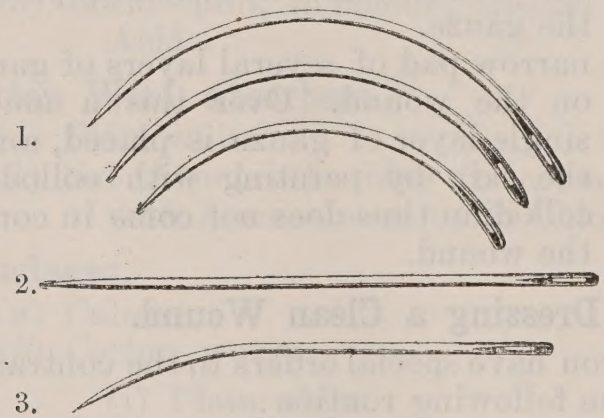

Fig. 90.
Surgical Needles.
1. Curved. 2. Straight. 3. Half curved.

Sutures may be interrupted or continuous.

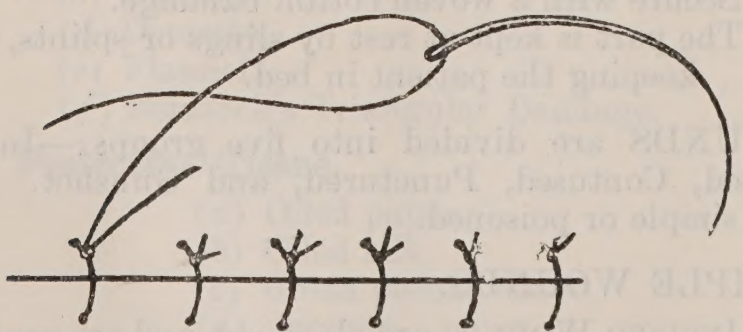

Fig. 91.
Interrupted Sutures.

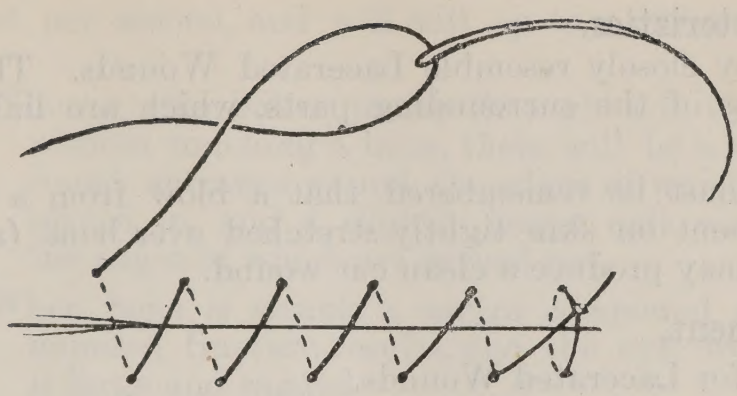

Fig. 92.
Continuous Suture.

Sutures are generally removed in seven days.

In large incised wounds, such as amputations, a drain of rubber tubing or gauze must be left in one corner to prevent the collection of serum separating the cut surfaces.

(B) LACERATED WOUNDS are produced by tearing, such as those resulting from machinery accidents.

Characteristics.

The edges are ragged; pieces of the skin or muscle may be torn away; the wound gapes; there is usually little hæmorrhage; there is often severe shock. They are very liable to become septic and they heal by second intention.

Treatment.

The wound must be very carefully and thoroughly cleaned, taking care to remove any foreign matter which may have been ground into it. All badly torn tissue is cut away. Treat the shock. In very severe cases amputation of a limb is often necessary.

AN ABRASION may be classed as a mild lacerated wound, and is produced by a fall or glancing blow which rubs off the epidermis only.

(C) CONTUSED WOUNDS are produced by crushing and falls, or by blows from blunt instruments.

Characteristics.

They closely resemble Lacerated Wounds. There is bruising of the surrounding parts, which are liable to slough.

It must be remembered that a blow from a blunt instrument on skin tightly stretched over bone (as the scalp) may produce a clean cut wound.

Treatment.

As for Lacerated Wounds.

(D) PUNCTURED WOUNDS are produced by narrow, pointed instruments, as in stabbing.

Characteristics.

The depth is greater than the width, and there is very little external hæmorrhage. The great danger is the possibility of injury to internal organs.

Treatment.

Never probe a Punctured Wound. Proceed as described under General Treatment. In some cases it may be necessary to enlarge the wound so as to reach a bleeding vessel, therefore prepare the necessary instruments.

If an internal organ be injured, treat as directed in "Wounds of Special Parts."

(E) GUNSHOT WOUNDS include those produced

(1) by rifle or
(2) revolver bullets,
(3) by the shot from sporting guns, and
(4) by shell.

Characteristics.

They may be lacerated, contused, or punctured wounds. Pain and shock may be severe, especially in shell wounds.

(1) The bullet of a modern Lee-Enfield rifle consists of a core of lead and antimony in an envelope of cupro-nickel alloy. It is 1·25 inches in length, ·311 inch in diameter, weighs 215 grains, has a muzzle velocity of

2,060 feet per second, and will kill up to a distance of 2 miles.

(*a*) When a rifle bullet passes through soft tissues without touching a bone, there will be a small round entrance wound, the edges of which are turned in, and a slightly larger exit wound, the edges of which are turned out.

(*b*) When bone is struck, a severe compound comminuted fracture results, and the exit wound is large and ragged.

(2) Revolver bullets cause wounds of the soft parts similar to those produced by rifle bullets. These wounds are only dangerous when the weapon is fired at close range and when they affect the skull, thorax, or abdomen.

(3) Wounds produced by sporting guns vary in severity with the range. When fired within a range of a few feet, the wounds are similar to those produced by a rifle bullet; and if the skull, thorax, or abdomen are affected, are often fatal. They diminish in severity with increase of range, until at about 150 feet the shot penetrate the skin only and lie embedded in it.

(4) Shell are of two kinds:—

(*a*) Common shell, which are hollow metal cylinders filled with an explosive and discharged by impact or by a time fuse.

(*b*) Shrapnel shell, which are filled with several hundreds of large round bullets in addition to the explosive.

The wounds are caused by the irregular fragments of the broken shell case and by the bullets of the Shrapnel; and are lacerated or contused in character.

In modern Naval warfare, lacerated and contused wounds will also be produced by metal and wooden splinters caused by the explosion of the enemy's shell.

Treatment.

These wounds will be treated as lacerated, contused, or punctured wounds. Treat the shock.

During an action, First Aid Treatment alone will be administered; but later, amputations and operations for the removal of bullets and fragments of shell will be undertaken.

II.—POISONED WOUNDS.

Any of the above-named wounds may be poisoned either at the time of the injury or subsequently.

The poison may be due to:—

A.—The Germs of Suppuration.
B.—Stings of Insects.
C.—Bites of Dogs and other Animals.
D.—Bites of Snakes.
E.—Erysipelas.
F.—Tetanus.

A.—A wound may be infected with **the germs of suppuration** at the time of the injury by the instrument which caused it, or later by the hands of the Medical Officer or Nurse, or by septic dressings, instruments, or sutures. This infection may result in one of the three Surgical Fevers, commonly called "blood-poisoning":—

(1) **Sapræmia,** where the toxins produced by the bacteria are alone circulating in the blood.
(2) **Septicæmia,** where the toxins and the bacteria themselves are circulating in the blood.
(3) **Pyæmia,** where abscesses form in different parts of the body, the bacteria being carried from the original focus by small detached blood clots.

A very serious form of septic infection is that known as a **Dissection or Post-Mortem Wound,** the poison being certain germs which live only in the dead body, and are the cause of its putrefaction. As the name implies, the infection is introduced while dissecting or examining a dead body.

Signs and Symptoms.

When a wound becomes septic the signs of inflammation and the symptoms of **Sapræmia** appear about 24 hours later. These symptoms consist of a rise in

temperature, often preceded by a rigor, headache, thirst, a dirty tongue, and scanty urine.

In **Septicæmia** the symptoms come on within 24 hours and are similar to, but more severe than, those of Sapræmia. The patient is dull and may be delirious. This is a very serious form of "blood-poisoning" and death is preceded by pallor and coldness of the skin, failing respiration, and a soft, feeble pulse.

Pyæmia does not come on for some days or weeks after the original infection. The abscesses usually form in the lungs, spleen, liver, kidneys, brain, or in the cellular tissue under the skin. Cases may last for months, but death generally results.

Treatment.

The treatment has been fully described under Abscess, the chief points being :—

(*a*) Allow the pus to escape.
(*b*) Use antiseptics freely.
(*c*) Keep up the patient's strength.

If an operation wound becomes septic, the sutures are removed (*but not without orders*) and the wound drained.

The treatment of the Surgical Fevers is carried out on the same lines.

Post-mortem wounds are treated at once, as described under the "Immediate Treatment of a Bite by a rabid Animal" (page 142).

B.—The poisoned wounds produced by the **stings of insects** are not as a rule dangerous, except when they occur about the throat, when asphyxia may result from the consequent swelling.

Treatment.

Extract the sting by pressing over it a small key; then apply Liquor Ammoniæ, Sanitas, Hydrogen Peroxide, or Vinegar. If there is much shock, stimulants will be necessary.

C.—Bites of healthy animals are lacerated or punctured wounds, which may or may not be septic. If the animal be "mad"—that is, suffering from a disease called Rabies

—the patient will almost certainly develop Hydrophobia.

Rabies occurs in dogs, cats, wolves and foxes, but is now practically never met with in the British Isles. The sick animal becomes depressed and irritable; it snaps at other animals and anyone near; thick mucus dribbles from its mouth, and it has difficulty in drinking. Death takes place in 5 or 6 days.

HYDROPHOBIA is a disease of human beings, caused by the bite of an animal suffering from Rabies. The poison is contained in the animal's saliva.

Symptoms.

These do not develop for about six weeks after the bite. The patient complains of giddiness and general malaise, followed by difficulty in swallowing and in breathing. Later, spasm of the muscles of respiration and swallowing occur almost constantly; the patient is in a state of terror, and dies in about four days.

Immediate Treatment of a Bite by a Rabid Animal.

(*a*) Prevent the poison getting into the general circulation by at once applying a ligature around the limb above the wound, sufficiently tightly to compress the veins but not the artery.

(*b*) Encourage bleeding by bathing with warm water.

(*c*) Cauterize the wound. Caustics are (i) solid; such as silver nitrate or a red-hot wire; or (ii) liquid; such as pure carbolic and nitric acids. Liquid caustics are the better as every corner of the wound will be touched.

(*d*) Apply an antiseptic dressing.

Later Treatment.

The patient undergoes the Pasteur Treatment, which consists of the injection of gradually increasing strengths of the hydrophobia toxin. The treatment lasts about a fortnight, and is almost invariably successful in preventing the occurrence of the disease.

Should the disease actually occur, attempts are made to check the convulsions with chloral hydrate or chloroform.

D.—SNAKE BITES are very uncommon in England, the only poisonous reptile being the adder, but are common in India, Africa, and America.

Symptoms.

The part bitten, usually the leg or hand, becomes red, swollen, and painful. The patient suffers from shock, nausea, and vomiting, while hæmatemesis and hæmaturia are not uncommon. Then follow paralysis of the respiratory muscles, sometimes convulsions, and coma. Death occurs in from 5 to 48 hours.

Treatment.

(*a*) Apply a ligature around the limb above the wound.

(*b*) Encourage bleeding by scraping the wound with a knife or needle.

(*c*) Cauterize the wound. A surgeon would previously cut out the wound together with the surrounding tissues.

(*d*) Rub thoroughly into the wound crystals of potassium permanganate.

(*e*) Treat the shock with stimulants.

(*f*) Apply artificial respiration.

E.—ERYSIPELAS is an acute infectious inflammation of the skin due to a definite germ—the *Streptococcus Erysipelatis*. The germ enters the skin through a wound which, however, may be so small as to be overlooked.

***Incubation Period,** 2 to 7 days.

Symptoms.

The patient complains of headache, general pains, shivering, loss of appetite, and possibly vomiting. On examination, his temperature will be found to be about 103° or 104°, and there will be a red flush around the wound. The red area feels boggy, is slightly raised, and has a very definite margin. Blisters may form on it, and, to

* *See* page 293.

the patient, it feels stiff. The redness spreads for a few days and then dies away, leaving the skin dry and scaly. The scales are infectious.

There may be delirium at night.

When the disease attacks the face, called **Facial Erysipelas,** the symptoms are often very severe. In these cases a wound of the skin is seldom found.

Treatment.

The patient must be isolated, and kept in bed, on a low but nourishing diet. Iron or quinine are usually given internally. Make a special report on the amount of sleep the patient gets and look out for delirium.

Lead and opium lotion, boric fomentations, carbolic compresses, various paints, ointments, or dusting powders are applied, and the part protected with cotton wool.

If the face be affected, a mask of lint must be applied with holes cut for the eyes, nose, and mouth.

Sometimes rings are drawn on the sound skin around the spreading edge of erysipelas with iodine or silver nitrate, to check the spreading of the disease.

F.—TETANUS is a disease caused by a wound becoming infected with the *Tetanus Bacillus.*

This bacillus is found in earth, especially when contaminated with horse dung; so that the people most liable to become infected are gardeners, farmers, and the victims of street accidents.

Incubation Period, 5 to 15 days.

Symptoms.

The wound may be suppurating or may have healed. The first symptom is pain and stiffness in the muscles of the lower jaw—hence the common name "lock-jaw." The next muscles to be affected are those of the neck and back; and finally those of the limbs. The convulsions, or spasms of the muscles, are *tonic;* that is to say, the muscles remain contracted during the attack, and do not alternately contract and relax as in clonic convulsions. When these convulsions occur, the muscles of the back may contract so much that the body becomes arched, and rests only on the back of the head and the heels.

During the illness the patient is conscious, his pulse is rapid, the temperature raised, and he sweats profusely.

Only about 1 per cent. of the cases recover, death taking place in from 1 to 4 days.

A chronic form of tetanus occurs, in which the symptoms are much milder but last a longer time, and about 20 per cent. recover.

Treatment.

The only satisfactory treatment is by injecting anti-tetanic serum.

Prevention.

All wounds which may have become infected are thoroughly cleaned, and antiseptics used freely.

WOUNDS OF SPECIAL PARTS.

THE SCALP.

These wounds are generally incised, but may have been caused by a blow with a blunt instrument, or by a fall. Hæmorrhage is free, but is easily controlled by pressure. The hair must be shaved for some distance around the wound, and sutures may be required.

Always get a Medical Officer to see a scalp wound, even if sutures are not required, as the skull may have been fractured.

THE FACE.

These wounds generally require stitching, so prepare fine needles and horsehair, and a collodion dressing.

THE EYE.

Wounds may or may not penetrate the walls of the eyeball. In penetrating wounds the aqueous or vitreous humour may escape, and the condition is always very serious.

Treatment.

Apply a light aseptic gauze pad and bandage until the case is seen by the Medical Officer.

THE TONGUE.

These wounds may bleed freely, but the hæmorrhage can be controlled by grasping the bleeding point between the finger and thumb.

Treatment.

Prepare needles and *catgut* sutures. No dressings are applied, but the patient is ordered an antiseptic mouthwash. See that he uses it freely, does not talk, and has soft food.

THE THROAT.

Cut throat is generally the result of attempted suicide, and is a very serious condition if the large blood vessels of the neck, the trachea, or larynx be injured. The patient may die from hæmorrhage, or from asphyxia caused by blood escaping into the trachea.

Treatment.

Arrest the hæmorrhage by applying digital pressure directly on the bleeding points, *taking care to press against the cervical vertebræ, and not against the trachea.* If this fail, or be impossible, compress the common carotid artery $1\frac{1}{2}$ inches above the sterno-clavicular joint. If the hæmorrhage be only venous, it may be controlled by packing the wound with aseptic gauze, and applying a bandage. If the trachea be opened, do not apply any dressing over it, nor allow the packing to enter the trachea.

Raise the patient's head on pillows, so that it is kept forward, which will help to bring the edges of the wound together.

Never leave the patient for a moment; he may tear off the dressings and start the hæmorrhage again.

The Surgical Treatment consists in sewing up the wound layer by layer, for which a general anæsthetic may be required. The wound is very liable to become septic, and septic pneumonia may follow.

THE CHEST.

Penetrating wounds of the chest are generally due to stabs or bullets, and the heart or lungs may be injured.

Wounds of the heart are usually rapidly fatal.

Wounds of the lungs cause hæmorrhage and shock. The blood which is coughed up is bright red and frothy.

Treatment.

Dress the wound and treat for internal hæmorrhage.

THE ABDOMEN.

Penetrating wounds of the abdomen cause shock and usually internal hæmorrhage. Any of the abdominal organs may be injured, and, if the wound be large, part of the intestines may protrude.

Treatment.

Dress the wound and treat for shock and internal hæmorrhage.

If the intestines protrude, do not attempt to replace them. Keep them warm by relays of sterilised towels wrung out of hot sterile water.

An operation under a general anæsthetic will be performed to investigate the extent of, and to repair, the damage done.

JOINTS.

When a wound opens into a joint, special pains must be taken to prevent sepsis occurring, because a stiff joint **(ankylosis)** would result.

TENDONS.

When tendons are cut, dress the wound and place the limb in such a position that there is as little strain as possible on these tendons. Thus, if the tendons on the front of the wrist are cut, flex the wrist; if those on the back, extend the wrist. Get a Medical Officer to see the case as soon as possible.

BURNS AND SCALDS.

BURNS are caused by the action of flames, hot solids, chemicals, or electricity.

SCALDS are caused by the action of hot liquids and steam.

These injuries will be discussed together, the word "burns" being used to include scalds also.

Degrees.

Burns may be divided into three classes, according to the depth of the injury :—

(1) Where there is only redness of the skin.
(2) Where the skin is also blistered.
(3) Where there is actual destruction of tissue.

Symptoms.

In addition to the visible injury, the patient will be suffering from shock and pain. The severity of the symptoms depends more on the extent of the burn than on its depth.

Treatment.

A.—First Aid.

In severe cases, it is of more importance to get the patient to bed quickly and treat the shock, than to waste time in dressing the burn, beyond covering those parts, such as the face or hands, which are exposed to the air.

When in bed, remove the clothing, taking care not to tear away the epidermis where it has become adherent to the clothing.

In burns of the first degree, a dusting powder or ordinary flour should be applied and covered with cotton wool and a bandage.

In burns of the second or third degree, apply boric ointment spread on broad strips of lint, cover with plenty of cotton wool and fix with a lightly applied bandage. If the boric ointment is too stiff mix it with vaseline, or the vaseline may be used alone. Carron oil, a mixture of linseed oil and lime water, is still sometimes used, but it is a dirty dressing and contains no antiseptic.

In ships not carrying a Medical Officer there is supplied a First Aid picric acid dressing. On opening the outer cover will be found lint treated with picric acid, and two triangular bandages. The lint is moistened with, *but not wrung out in*, water and applied.

B.—Surgical.

Treat the shock.

Prepare a hypodermic syringe and morphia. The apparatus for infusing normal saline solution may also be required.

When the patient has recovered from the shock, the burns are thoroughly cleaned with some mild antiseptic, such as warm boric lotion, and all blisters opened. A general anæsthetic may be required. As a dressing, strips of lint wrung out in a solution of picric acid (40 grains to the pint) are applied, covered with a thick layer of cotton wool, and bandaged.

Always apply the dressings in strips, so that when they are changed the whole of the burnt surface need not be exposed at one time.

In some cases, the burn is treated by continual submersion in an alkaline or boric bath. Baths are also used to loosen the old dressings when they require changing.

Later, when the burn has become an ordinary suppurating wound, it may be dressed with stronger antiseptics.

Burns of the face are usually treated with boric ointment spread on a mask of lint.

Complications.

The immediate complication is shock.

Later, sepsis, pneumonia, and deformity are to be feared. Severe burns always become septic. The deformity is due to the contraction of the resulting scar, which may cause flexion of the limbs or the drawing down of the lower eyelid, &c. To prevent this deformity, **skin grafting** is employed. There are two methods of performing this. In each case the wound must be in a clean and healing state before the grafts are applied.

(*a*) Minute pieces of healthy skin, consisting of the epidermis and the tips of the papillæ of the dermis, are cut off with scissors and placed here and there on the wound, which is not completely covered. A dressing of oiled silk covered with gauze and cotton wool is applied.

(*b*) Thiersch's method consists in removing broad strips of skin, usually from the thigh or arm, with a

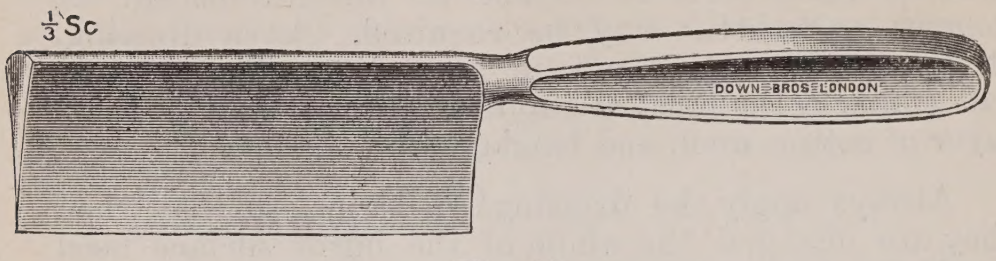

Fig. 93.

Thiersch's Knife.

Thiersch's skin-grafting knife. This consists of a large heavy razor-blade with a fixed handle. With these strips the wound is entirely covered.

Chapter VII.

FRACTURES.

A fracture is a broken bone.

Causes.

A.—**Violence.**

(1) **Direct Violence,** where the bone is broken at the point at which the violence is applied.

(2) **Indirect Violence,** where the bone is broken at a point some distance from that at which the violence is applied, and where the bone is bent or twisted before breaking.

(3) **Muscular Action,** where the bone is broken by the sudden contraction of some attached muscle.

B.—**Disease** of the bone. This is a very uncommon cause.

Varieties.

(1) **Simple Fracture,** where the bone is broken in one place, without injury to the skin or adjacent parts.

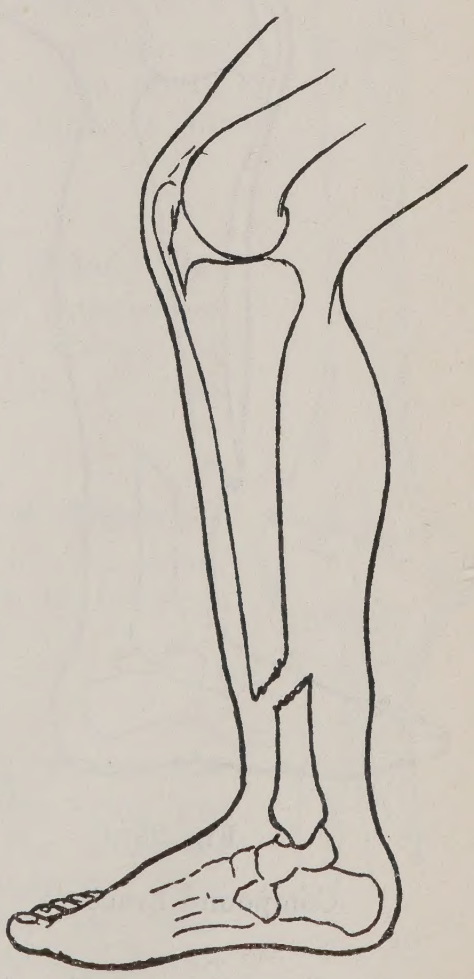

Fig. 94.
Simple Fracture.

(2) **Compound Fracture,** where there is a wound of the skin or mucous membrane leading down to the broken ends of the bone. The bone need not protrude through the skin.

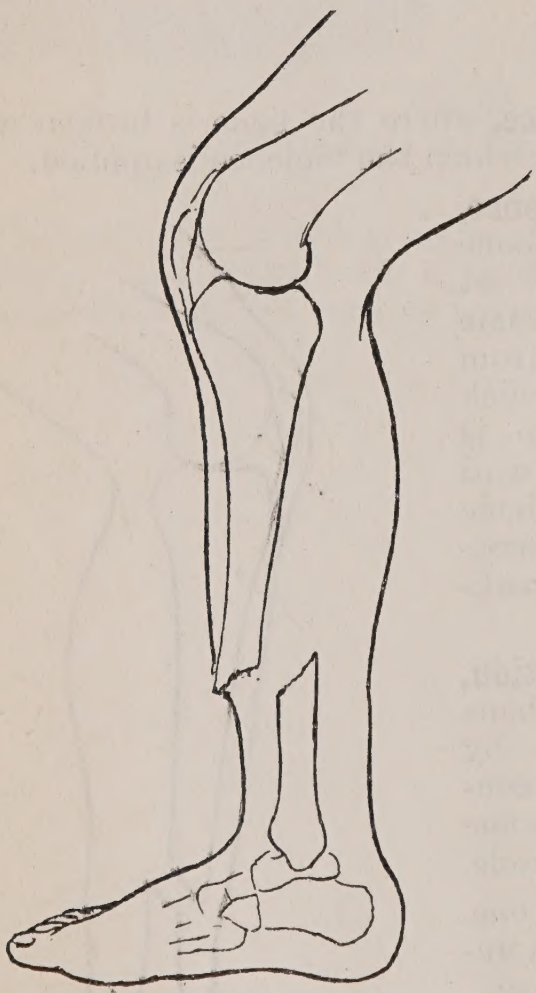

Fig. 95.

Compound Fracture.

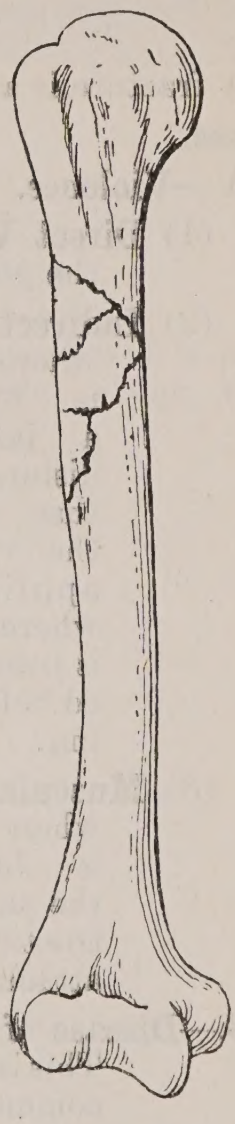

Fig. 96.

Comminuted Fracture.

(3) **Comminuted Fracture,** where the bone is broken in more than one place.

(4) **Complicated Fracture,** where in addition to the fracture there is also injury of other tissues or organs, such as :—

(*a*) **Injury of Internal Organs**—for example, the brain, lungs, and bladder, in fractures of the skull, ribs, and pelvis respectively.

(*b*) **Injury of Joints**—such as in cases of fracture of the lower end of the femur where the knee joint is injured.

(*c*) **Injury of Blood Vessels**—such as the Subclavian Artery being lacerated by the broken ends of the Clavicle.

(*d*) **Injury of Nerves**—such as injury of the Musculo-spiral Nerve in fracture of the Humerus.

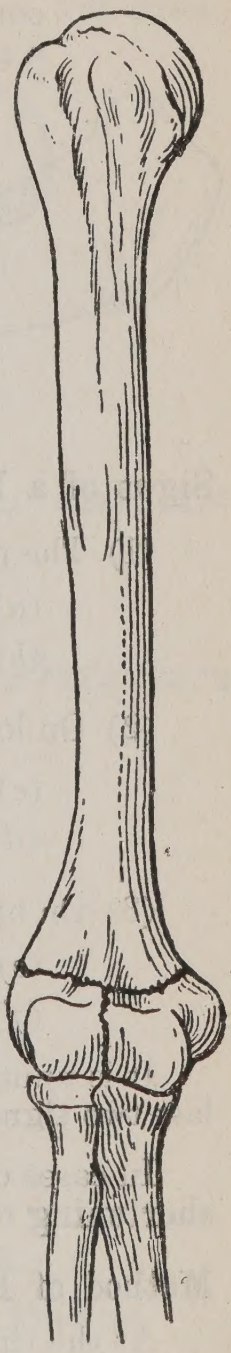

Fig. 97.
Complicated Fracture.

(5) **Impacted Fracture,** where the broken ends of the bone are driven one into the other at the time of the injury. This frequently happens in fractures of the neck of the Femur and of the lower end of the Radius.

(6) **Greenstick Fracture,** where the bone is not completely broken, as when one tries to break a green twig. This form occurs in children.

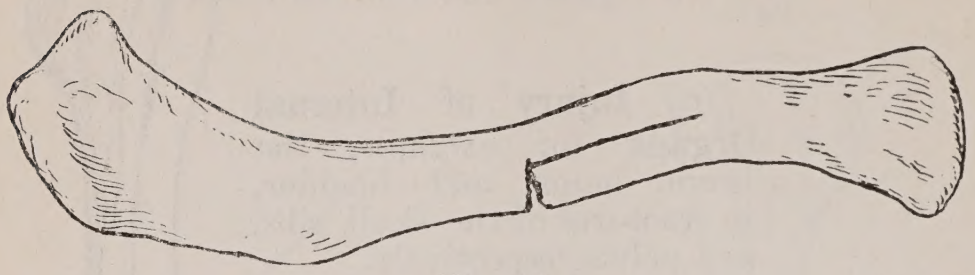

Fig. 98.
Greenstick Fracture.

Signs of a Fracture.

(1) The patient complains of

(*a*) **Pain.**
(*b*) **Loss of power.**

(2) On looking at the part there will be seen

(*c*) **Swelling.**
(*d*) **Deformity.**

(3) On examination of the part there will be found

(*e*) **Unnatural mobility.**
(*f*) **Crepitus.***

It is unnecessary and inadvisable to demonstrate the last two signs in First Aid work.

In cases of fracture of a long bone there will also be **shortening** of the limb.

Method of Healing.

At the time of the injury blood will escape from the bone, the periosteum, and possibly from adjacent muscles.

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* By *crepitus* is meant the grating sensation produced by rubbing the broken ends of the bone together.

This blood clots, becomes organised by new blood vessels which form in it, and so there is produced a soft mass of granulation tissue which surrounds the broken ends of the bone and is called *callus*.

This callus becomes gradually harder owing to the deposit of lime, and at the end of three weeks it exactly resembles hard bone. The callus acts as a splint, and holds the ends of the bone in position until they have united, when it is gradually absorbed.

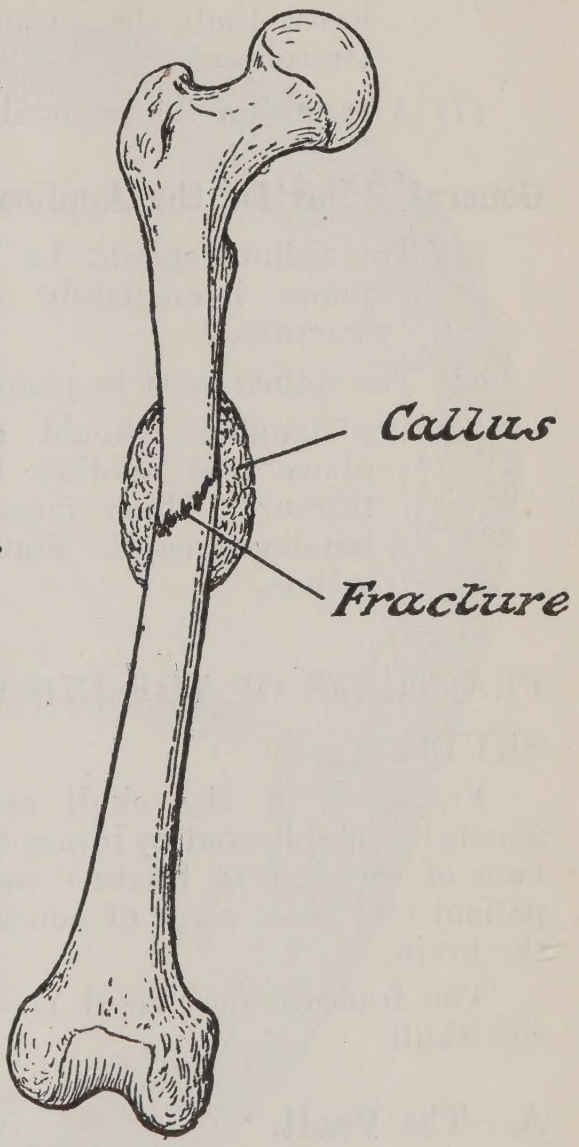

Fig. 99.

Callus round a Fracture.

General Treatment of Fractures.

(1) Treat the fracture on the spot before attempting to move the patient.

(2) Correct the deformity by pulling gently and steadily on the lower part of the limb.

(3) Fix the limb in the corrected position by means of splints and bandages.

(4) Dress any wound which may be present.

(5) Treat any complications, such as hæmorrhage and shock.

(6) Relieve the patient of all muscular effort. If the fracture is of a bone of the upper limb, the arm must be supported in a sling; if of the lower limb, the patient must be carried on a stretcher.

(7) Arrange for the removal of the patient.

General Rules for the Application of Splints.

(1) The splints should be long enough to fix the joints immediately above and below the fracture.

(2) The splints must be padded.

(3) One bandage should be applied immediately above and another below the seat of the fracture, which must be left clear. Other bandages may be applied near the ends of the splints.

FRACTURES OF THE INDIVIDUAL BONES.

SKULL.

Fractures of the skull are often compound and generally complicated by injury to the brain. Frequently none of the signs of fracture can be discovered, but the patient may show signs of concussion or compression of the brain.

The fracture may be of the Vault or of the Base of the Skull.

A.—The Vault.

Cause.—Usually direct violence.

Varieties.

(1) **Fissured Fracture,** where the bone is merely cracked without any displacement of the fragments. The chief danger is compression of the brain due to internal hæmorrhage. (*See* Fig. 100, page 157.)

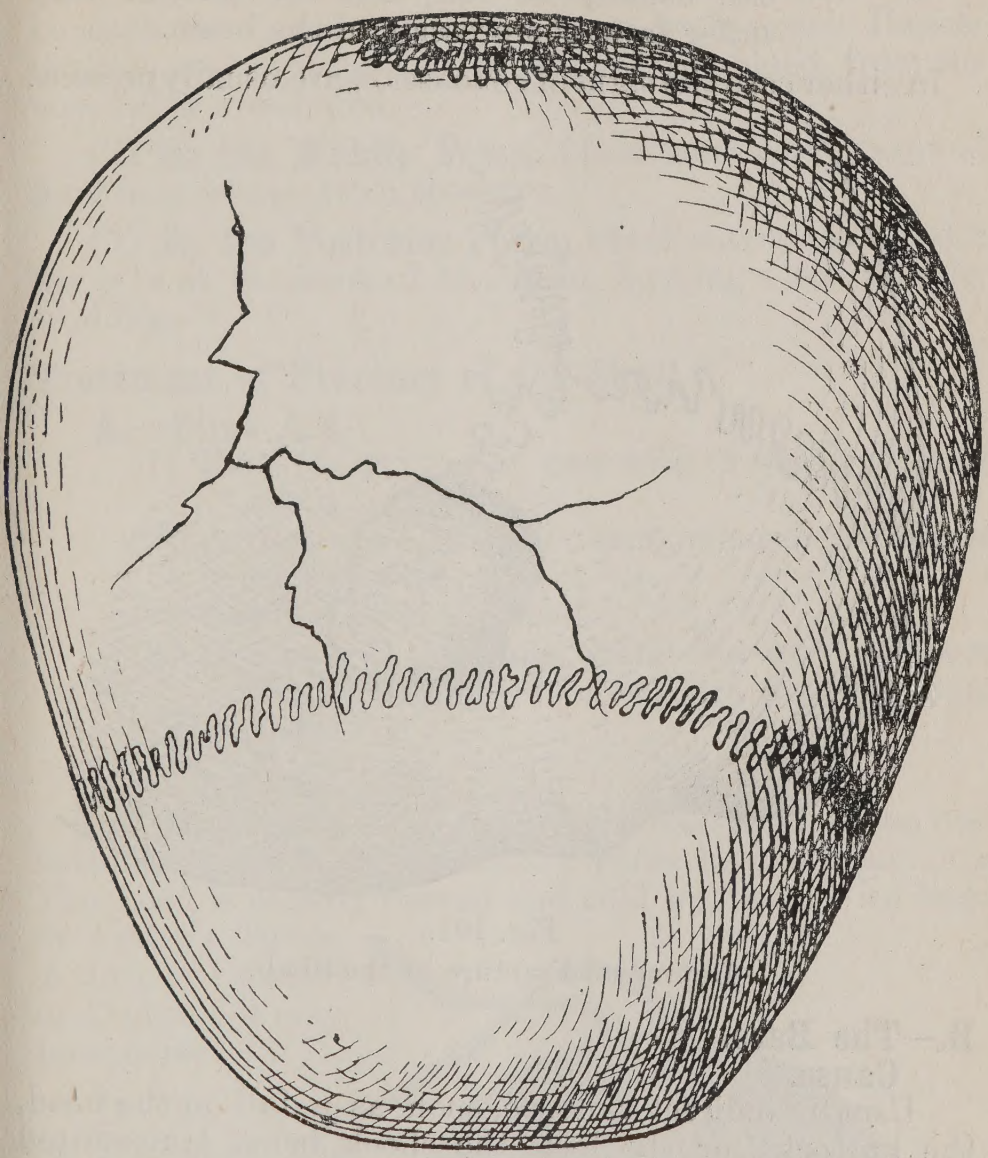

Fig. 100.

Fissured Fracture of the Skull.

(2) **Depressed Fracture,** where a piece of the skull is driven inwards. The depression so formed can usually be felt, and the patient may suffer from compression of the brain.

In either case the signs of concussion are usually present.

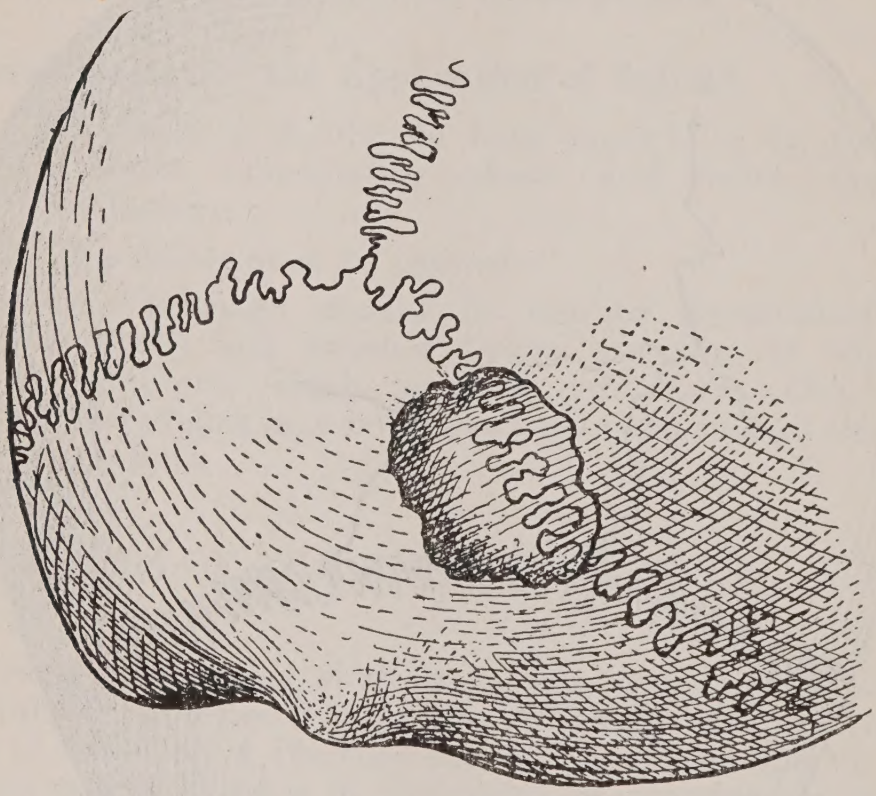

Fig. 101.
Depressed Fracture of the Skull.

B.—The Base.

Cause.

Usually indirect violence, such as a fall on the head, the buttocks, or the feet, the shock being transmitted through the vertebral column to the base of the skull and resulting in a fissured fracture.

This is an extremely serious accident because of the liability to injury of the many important structures at the base of the brain.

Signs.

The patient will become suddenly or gradually unconscious, or death may occur almost instantaneously.

The signs vary according to the position of the fracture.

(1) **In the Anterior Fossa,** blood and cerebro-spinal fluid may escape from the nose, or blood may appear beneath the conjunctiva of one or both eyes. Hæmatemesis may occur owing to some of the blood from the nose being swallowed.

(2) **In the Middle Fossa,** blood and cerebro-spinal fluid may escape from the ears.

(3) **In the Posterior Fossa,** blood may collect under the skin at the back of the head, forming a soft doughy swelling.

Treatment of Fracture of the Skull.

A.—First Aid.

(1) Keep the patient at rest with the head slightly raised.
(2) Arrest any external hæmorrhage and dress any wounds.
(3) Apply cold to the head.
(4) If there is bleeding from the nose or ears do not attempt to check it. *Keep the ears clean.*

B.—Surgical.

The patient is kept quiet in a darkened room, and nothing is given by the mouth while he is unconscious. The head is usually shaved and cold applied by ice bags or Leiter's Tubes. A dose of Calomel or Croton Oil may be ordered.

If the Vault be fractured, the operation of Trephining may be performed to elevate the depressed bone or to arrest the internal hæmorrhage.

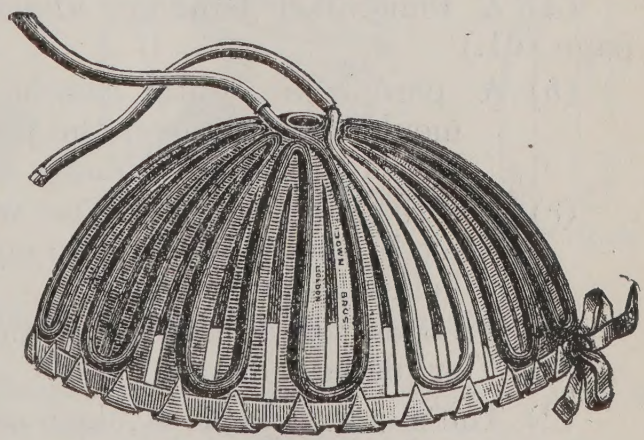

Fig. 102.
Leiter's Tubes.

If the Base be fractured, rest and quiet are essential. If blood or cerebro-spinal fluid escape from the ears or nose, these cavities must be washed out with some antiseptic lotion and the ears lightly plugged with aseptic gauze.

LOWER JAW.

The fracture may be of the body, ramus, or condyle, and is usually compound, the mucous membrane covering the gums being torn.

Cause.—Direct violence.

Signs.—All the general signs of a fracture.

If the body be fractured the gums will be torn and bleeding, and there will be an irregularity in the line of the teeth. Talking is painful or even impossible.

Treatment.

A.—First Aid.

Raise the drooping part of the jaw until the upper and lower teeth are touching. Apply a triangular or four-tailed bandage.

B.—Surgical.

(1) The fracture is fixed by a splint, of which the following are most used :—

(*a*) A four-tailed bandage alone. (*See* Fig. 103, page 161.)

(*b*) A poroplastic, gutta percha, or leather splint moulded to fit over the jaw and held in place by a four-tailed bandage.

(*c*) A wire dental splint. The wire is fixed to the teeth and so the broken ends of the bone are held in place.

(*d*) An operation is performed and the bone is wired or plated.

(2) The mouth is kept as clean as possible. Various antiseptic lotions, such as Listerine, Hydrogen Peroxide, or Potassium Permanganate, are used frequently and especially after meals.

(3) Arrangements are made for feeding the patient. Slops alone are given by one of the following methods :—

(*a*) By pouring the fluid, a little at a time, between the teeth and the cheek.

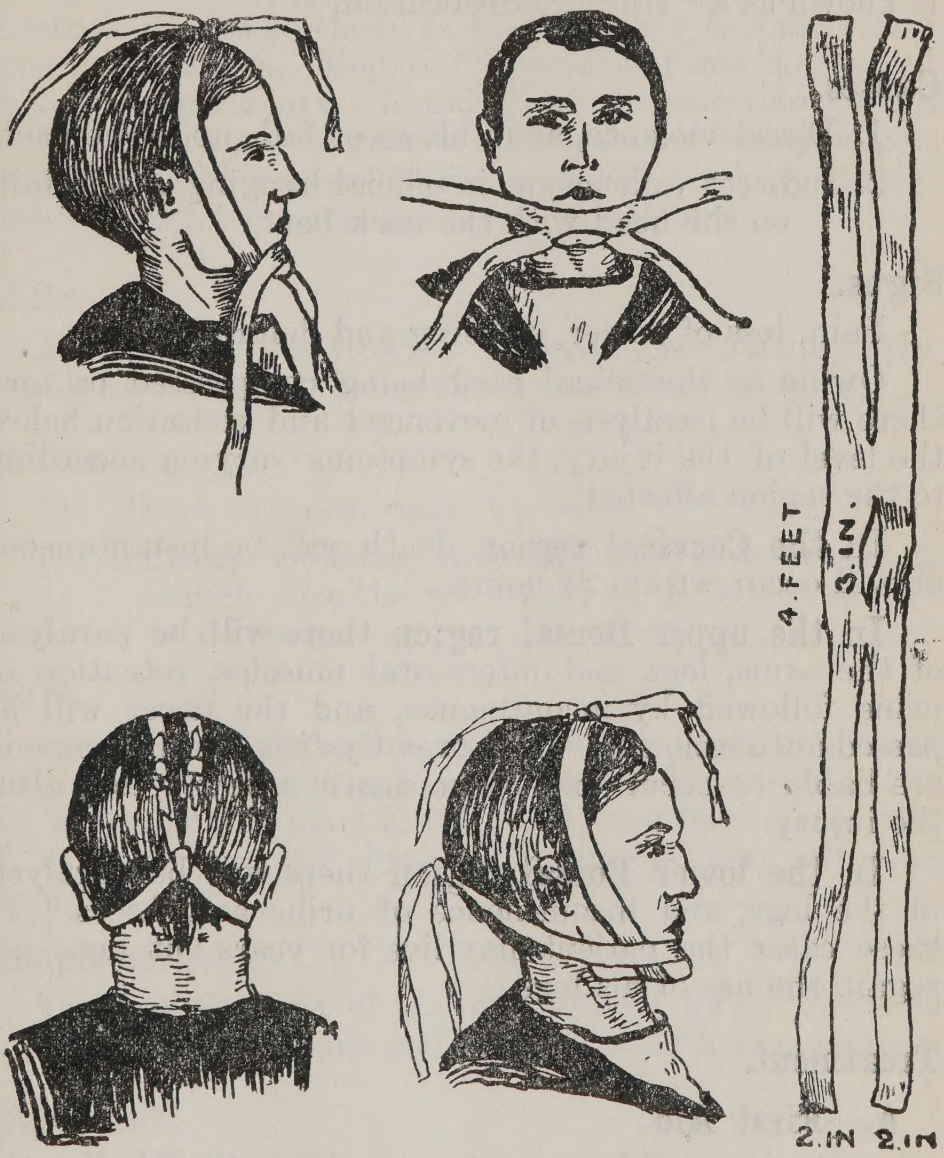

Fig. 103.
Four-tailed bandage. (First Aid in the Royal Navy.)

(*b*) By a tube passed into the mouth where a tooth is missing or has been purposely extracted.

(*c*) By the nasal tube.

(*d*) By nutrient enemata.

SPINE.

A fracture of the spine is practically always accompanied by dislocation of the vertebræ, and so the condition is known as a "fracture-dislocation."

Causes.

1. Direct violence, as in blows or falls upon the back.
2. Indirect violence, as in official hanging and in falls on the head with the neck bent.

Signs.

Pain, loss of power, swelling and deformity.

Owing to the spinal cord being compressed or torn there will be paralysis of movement and sensation below the level of the injury, the symptoms varying according to the region affected.

In the Cervical region death will be instantaneous or will occur within 24 hours.

In the upper Dorsal region there will be paralysis of the arms, legs and intercostal muscles, retention of urine followed by incontinence, and the fæces will be passed unconsciously. Bedsores, Cystitis, and Pneumonia are liable to occur and cause death a few weeks after the injury.

In the lower Dorsal region there will be paralysis of the legs, and incontinence of urine and fæces. In these cases the patient may live for years but does not regain the use of his legs.

Treatment.

A.—First Aid.

(1) If possible, do not move the patient before the arrival of the Medical Officer.

(2) If his removal is imperative, place him on a firm wooden (*not canvas*) stretcher, such as a door, shutter, or gate, and place him finally on a fracture bed.

(3) Treat the shock.

B.—Surgical.

The patient is nursed on a fracture bed, and every effort made to prevent bedsores. A draw-sheet and mackintosh are required. Keep a careful watch on the sheets, and change them as soon as they become soiled by urine or fæces. Report if the patient has not passed urine for some hours. Avoid all unnecessary movement.

Sometimes an operation, called *Laminectomy*, is performed. This consists of the removal of the vertebral arches which are compressing the spinal cord.

RIBS.

Fracture of the ribs is a very common accident, the fourth to the eighth being those most often broken.

Causes.

(*a*) Direct violence, such as a blow.

(*b*) Indirect violence, generally due to a crush, in which case the rib breaks at the sharpest part of its curve.

Signs.

Severe stabbing pain on taking a deep breath or coughing, and crepitus, which may be demonstrated at the same time by placing the hand over the injured rib. If several ribs are broken deformity may also be observed.

Complications.

The broken ends of the rib may be forced inwards and lacerate the pleura and lung, causing hæmoptysis.

Treatment.

A.—First Aid.

If the lung is not damaged, apply two or more broad-fold bandages firmly around the chest *at the end of expiration*. Place the arm of the injured side in a broad sling.

If the lung is damaged, do not apply the bandages tightly and treat as for internal hæmorrhage.

B.—Surgical.

The chest is strapped. Strips of adhesive plaster, about 2 inches wide and a little longer than half the circumference of the chest, are applied from below upwards. Each strip should overlap the previous piece and be *applied at the end of full expiration.* The whole is then covered with a roller bandage and must be worn for at least 3 weeks.

STERNUM.

This may be due to direct or indirect violence, but is a very uncommon fracture.

Treatment is carried out on the same lines as for fractured ribs.

CLAVICLE.

This is one of the commonest fractures.

Cause.

Usually indirect violence, such as a fall on the outstretched hand or on the shoulder.

Signs.

Pain, inability to raise the arm, drooping of the shoulder, irregularity in the line of the bone, and crepitus.

The patient inclines his head towards the injured side, and supports his elbow with the hand of the sound side.

Treatment.

A.—First Aid.

To correct the deformity, the shoulder must be braced backwards, levered outwards, and raised. The method of applying the triangular bandage for this fracture is described under "Bandaging," p. 265.

B.—Surgical.

The usual treatment is by what is called *Sayre's method*, in which three strips of adhesive plaster, 3 inches

wide, are required. The end of one piece is looped round the upper arm, with the non-adhesive side next the skin ; the loop being formed by stitching or pinning. The elbow is forced well back and the strapping,

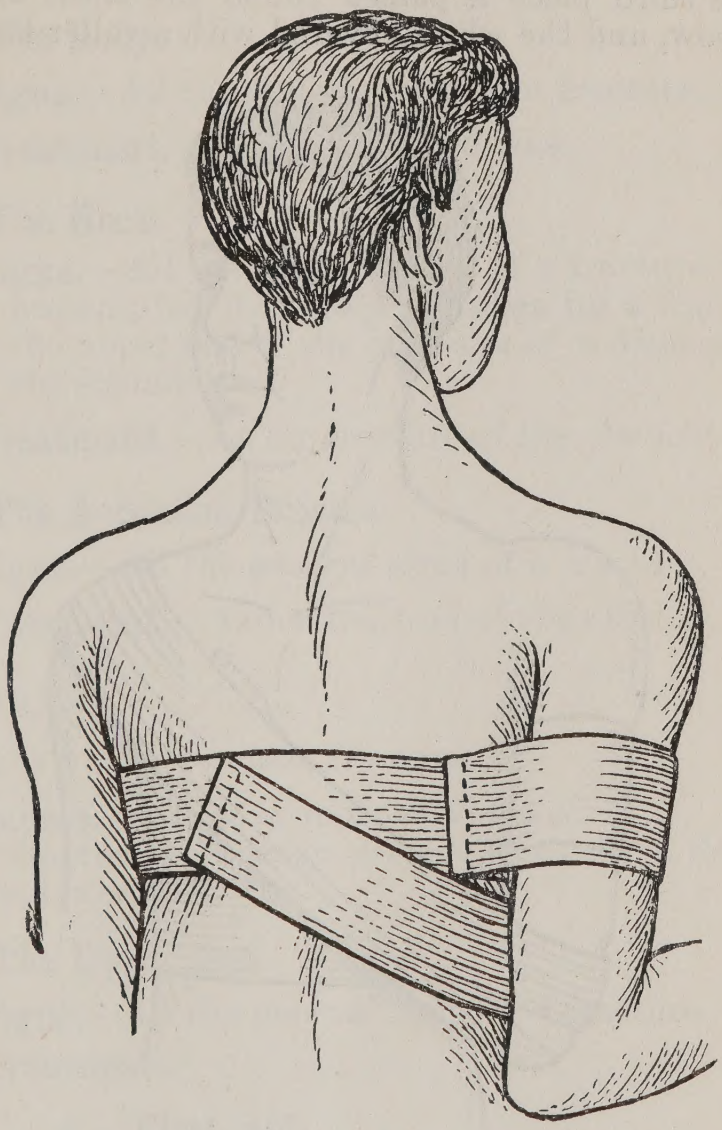

Fig. 104.

Sayre's Dressing for Fracture of the Clavicle (1).

adhesive side next the skin, is brought round the back and finishes at the front of the chest. The forearm is now placed across the chest with the fingers pointing towards the opposite shoulder.

The second piece of strapping commences at the back of the sound shoulder, passes diagonally across the back, over the point of the elbow, and along the back of the forearm, and finishes at the sound shoulder.

The third piece is passed round the chest and over the elbow, and the whole covered with a roller bandage.

Fig. 105.

Sayre's Dressing for Fracture of the Clavicle (2).

A flannelette roller bandage may be used instead of the strapping. In some cases the bone is wired.

These fractures take about three weeks to heal.

SCAPULA

This is usually due to direct violence, but is not a common fracture.

The body, neck or acromion process may be broken.

1. The Body.

Signs.—All the general signs of a fracture.

Treatment.—As for fractured ribs.

2. The Neck.

Signs.—All the general signs of a fracture will be present, but it is often mistaken for a fracture of the upper end of the humerus or a dislocation of the shoulder.

Treatment.—As for fracture of the clavicle.

3. The Acromion Process.

Signs.—All the general signs of a fracture.

Treatment.—As for fracture of the clavicle.

HUMERUS.

This is a very common fracture.

Causes.—Direct or indirect violence.

The fracture may occur at the upper end, in the shaft or at the lower end.

1. The Upper End.

Signs.—All the general signs of a fracture.

Treatment.

A.—First Aid.

Fix the arm to the side by means of a broad bandage and put the forearm in a *narrow* sling.

B.—Surgical.

A moulded poroplastic or leather splint may be applied over the shoulder; or a triangular splint may be

used, the base being fixed to the patient's side while the injured arm rests on the other two sides of the triangle. Other methods of treatment are by bandaging the arm to the side or by wiring the fragments.

2. The Shaft.

Signs.—All the general signs of a fracture.

Treatment.

A.—First Aid.

After reducing the deformity apply two splints, one reaching from the point of the shoulder to just below the elbow, the other from the axilla to the elbow, and fix by two bandages. Place the forearm in a *narrow* sling.

Beware of causing pressure on the axillary artery by the upper end of the internal splint.

B.—Surgical.

A piece of Gooch splinting is shaped to surround the arm without causing pressure in the axilla or in the bend of the elbow, and fixed by straps and buckles or bandages. An internal angular splint is sometimes used in addition.

The fragments may be wired or plated.

These fractures heal in about four weeks.

3. The Lower End.

Signs.—The signs are often indefinite or masked by swelling, and the fracture is sometimes mistaken for a dislocated elbow.

Treatment.

A.—First Aid.

Tie two splints together at right angles, in the form of the letter L; the shorter limb is applied to the inner

side of the upper arm, and the longer limb to the front of the forearm. The thumb must point towards the chin. Fix with bandages around the upper arm, wrist and hand, and place in a *broad* arm sling.

Cold water dressings may be applied to the swollen joint.

B.—Surgical.

Treatment may be by angular splints or by operation according to the exact position of the fracture.

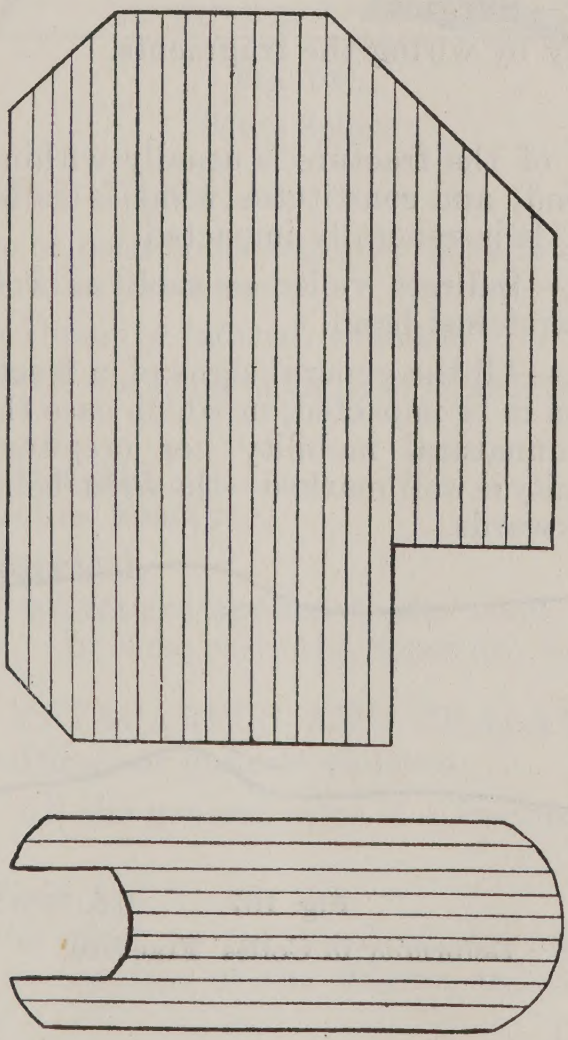

Fig. 106.

Gooch splinting, cut for Fracture of the Humerus.

ULNA.

The part affected is usually the olecranon process.

Causes.—Direct violence or muscular action.

Signs.—All the general signs of a fracture. A distinct gap may be felt between the olecranon and the shaft of the ulna.

Treatment.

A.—First Aid.

As for fracture of the lower end of the humerus.

B.—Surgical.

Usually by wiring the fragments.

RADIUS.

The site of the fracture is usually within an inch of the lower end, and constitutes what is called **"Colles' Fracture."** It is generally impacted.

Cause.—Indirect violence, such as a fall on the outstretched hand.

Signs.—All the general signs of a fracture, except when it is impacted, in which case there will be no unnatural mobility nor crepitus. The deformity is well marked—the wrist being displaced backwards.

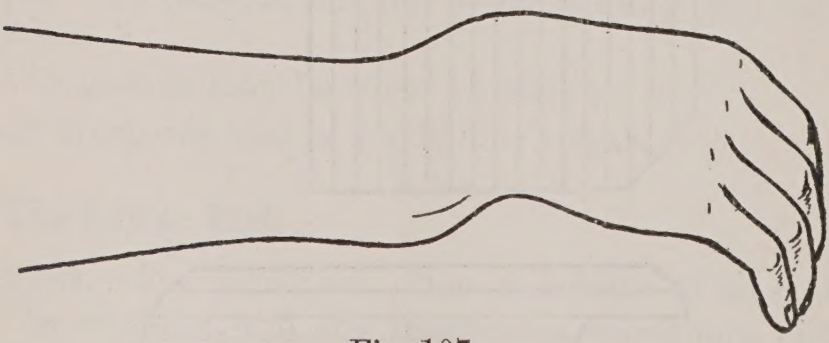

Fig. 107

Deformity in Colles' Fracture.

Treatment.

A.—First Aid.

Place the forearm across the chest with the thumb pointing upwards and apply splints, which must reach

from the elbow to the tips of the fingers, to the back and front of the limb. Support in a *broad* sling.

B.—Surgical.

To reduce the deformity a general anæsthetic is usually necessary. The splints employed are Carr's, Gordon's or the pistol splint; and massage is prescribed to prevent a stiff joint.

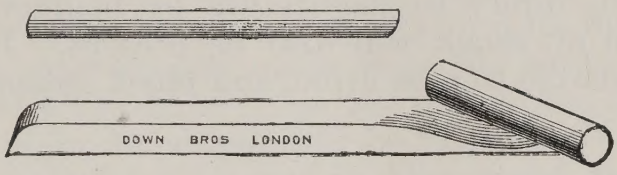

Fig. 108.
Carr's Splint.

RADIUS AND ULNA.

Fracture of both bones together usually occurs about the middle of the forearm.

Cause.—Direct or indirect violence.

Signs.—All the general signs of a fracture.

Treatment.

A.—First Aid.

As for Colles' Fracture.

B.—Surgical.

Straight splints are applied to the front and back of the forearm. In some cases the bones are wired.

CARPUS, METACARPUS AND PHALANGES.

Cause.—Direct or indirect violence.

Signs.—All the general signs of a fracture.

Treatment.

A.—First Aid.

Apply one splint to the front of the forearm, from the elbow to the tips of the fingers, and support in a *broad* sling.

B.—Surgical.

Splints of various shapes, sizes and material are employed according to the nature of the fracture.

PELVIS.

The Iliac and Pubic Bones are commonly fractured, but the Ischium, Sacrum, and Coccyx only rarely.

Causes.—Direct violence, as by a blow.
Indirect violence, as by a crush.

Signs.—Pain, inability to stand and crepitus are the usual signs of a simple fracture; but it is often complicated by injury to the urethra or bladder, when the symptoms of shock will also be present. The patient may be unable to pass urine, and blood escapes from the urethra.

Treatment.

A.—First Aid.

Apply two broad bandages firmly around the pelvis. Exercise the greatest care in moving the patient.

If blood is escaping from the urethra warn the patient not to attempt to pass urine, and treat the shock.

B.—Surgical.

Uncomplicated cases are treated by applying simple roller or plaster-of-Paris bandages around the pelvis.

In complicated cases, catheters will be required at once and an operation is usually necessary to repair the damage.

FEMUR.

This bone may be broken at the neck, in the shaft or through the condyles.

1. The Neck.

Cause.—Indirect violence, as by slipping off the kerbstone, in old people.

Signs.—As these fractures are often impacted, the only signs may be pain, loss of power, and shortening of the limb.

2. The Shaft.

Causes.—Direct or indirect violence.

Signs.—All the general signs of a fracture. The foot is turned outwards and there is considerable shortening of the limb.

3. The Condyles.

Cause.—Direct violence.

Signs.—All the general signs of a fracture.

Treatment.

A.—First Aid.

Lay the patient on his back; correct the deformity by pulling on the foot while an assistant steadies the upper part of the thigh; fix in this position by splints, of which the outer should reach from the axilla to beyond the foot, and the inner from the fork to the knee. The following eight bandages will be required:—one broad-fold round (1) the chest, and another round (2) the hips; narrow-fold bandages round the thigh (3) just above, and (4) just below the fracture, round the leg (5) below the knee, and (6) above the ankle, round (7) both knees and (8) both ankles and feet.

If a Liston's long splint can be obtained, extension should be applied by means of the perineal band,—a narrow-fold bandage the centre of which is placed in the fork between the legs and the ends passed through the two holes in the upper end of the splint and firmly tied. This must be applied after the bandages are in position.

Treat for shock and remove on a stretcher.

B.—Surgical.

An anæsthetic is generally given to overcome the contraction of the muscles and to get the broken ends of the bone in apposition. The fracture will then be treated by one of the following methods:—

(1) **By Liston's Long Splint with Extension.**

The limb is washed and shaved; then broad pieces of strapping are attached to the inner and outer sides of the leg from just below the site of the

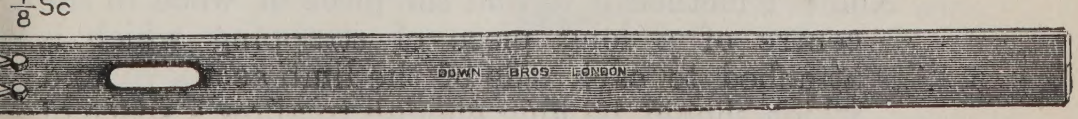

Fig. 109.

Liston's Long Splint.

fracture to just above the ankle, where the strapping is folded to form a stout band which does not stick to the skin over the malleoli, but projects for some 6 inches beyond the foot. This strapping is held in position by other narrow strips wound spirally round the limb and by a roller bandage over all. A flat piece of wood, about 5 inches by 3 inches, called a stirrup, fitted with short straps and buckles, is then buckled on to the ends of the strapping, and a cord, knotted at one end and passed through a hole in

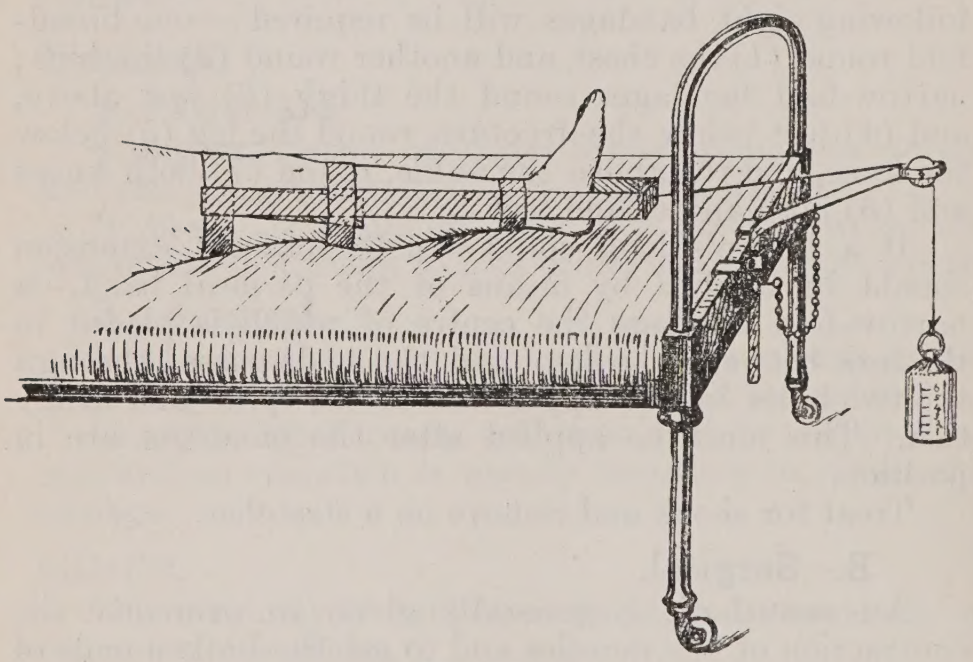

Fig. 110.

Extension Apparatus.

the centre of the stirrup, runs over a pulley fixed to the foot of the bed and supports the necessary weights.

Another method is to fold the piece of wood in the centre of a long piece of strapping which is attached to each side of the limb as above, and which should be long enough to allow a space of 2 or 3 inches between the sole of the foot and the stirrup.

The use of the stirrup is to prevent the strapping pressing on the malleoli, which should be further protected by cotton wool pads.

The weight required at the end of the cord will be from 5 to 10 lbs.

Liston's long splint, carefully padded, is now fixed to the outer side of the leg by a roller towel or broad bandage around the chest, and by bandaging from the ankle to the knee. The inner splint consists of Gooch splinting which surrounds the thigh and is kept in position by two straps with buckles.

Finally, the lower end of the Liston is placed in the notch of a cross piece which prevents rotation of the limb; the foot of the bed is raised on blocks, and the weight applied last.

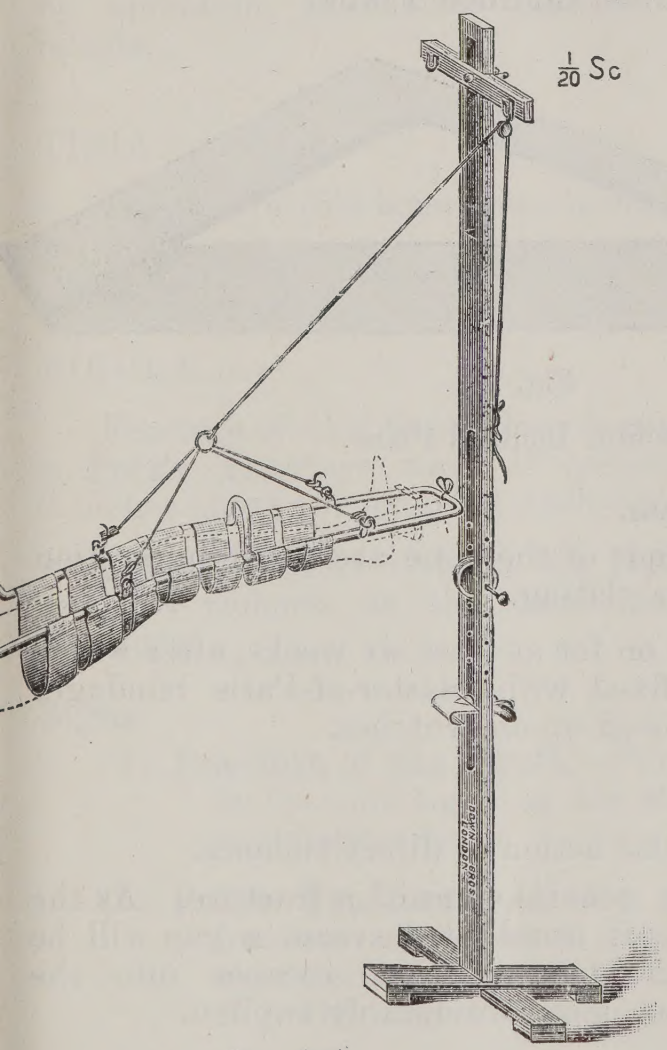

Fig. 111.
Hodgen's Splint.

(2) **By Hodgen's Splint.**

This consists of a stout wire framework extending from the groin to well below the foot, and slightly bent at the knee. Extension strapping, with stirrup and

cord, are first applied to the limb, which is then supported in the splint by fixing broad pieces of flannel bandage to either side of the frame, forming a sort of trough, and the cord tied to the lower end of the splint. A long stout pole is fixed to the foot of the bed, and from the top of it the splint is slung by cords, the limb swinging well clear of the bed.

(3) **By the Double Inclined Plane.**

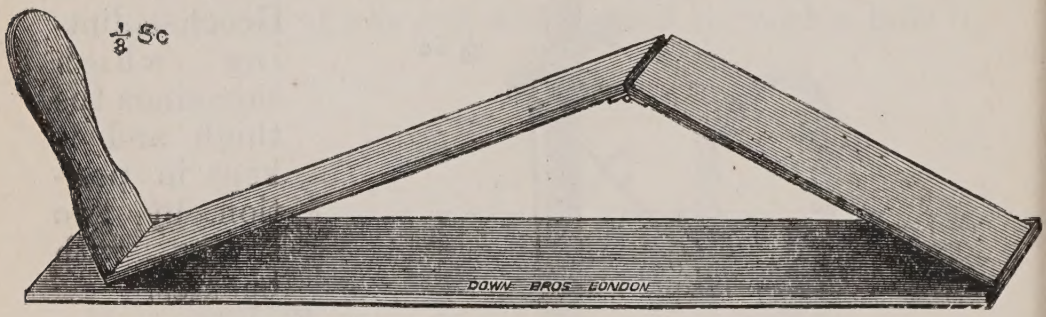

Fig. 112.

Double Inclined Plane.

(4) **By Operation.**

The broken ends of the bone are fixed in position by wiring or plating.

Splints are kept on for at least six weeks, after which the limb may be fixed with plaster-of-Paris bandages and the patient allowed up on crutches.

PATELLA.

Causes.—Muscular action or direct violence.

Signs.—All the general signs of a fracture. As the line of the fracture is usually transverse a gap will be felt between the fragments. Blood escapes into the knee joint, which becomes considerably swollen.

Treatment.

A.—First Aid.

Place the patient on his back with the shoulders and heels raised. Apply a splint to the back of the leg from

the buttocks to the heel, and fix by bandages around the thigh and ankle. Place a narrow-fold bandage above the upper fragment, cross the ends over the splint behind the knee, and tie off in front below the lower fragment. A second bandage may be applied in the reverse order, commencing below the lower fragment.

B.—Surgical.

These cases are treated either with back splints or by operation, the latter perhaps giving the better results.

TIBIA.

Fracture of this bone alone is very rare.

Treatment.—As for both bones of the leg.

FIBULA.

Fracture of this bone alone is common, and is called a **Pott's Fracture** when it occurs at a point about 2 inches above the external malleolus.

Causes.—Direct violence for fractures of the shaft. Indirect violence is the commoner cause of Pott's Fracture.

Signs.

(1) **Fracture of the Shaft.**—Pain and crepitus may be the only signs as the strong Tibia prevents any displacement.

(2) **Pott's Fracture.**—All the general signs of a fracture. The foot is displaced outwards, and the internal malleolus is very prominent. (*See* Fig. 113, page 178.)

Treatment.

A.—First Aid.

Treat as for fracture of both bones of the leg.

B.—Surgical.

(1) **Fracture of the Shaft** is treated as if both bones were broken.

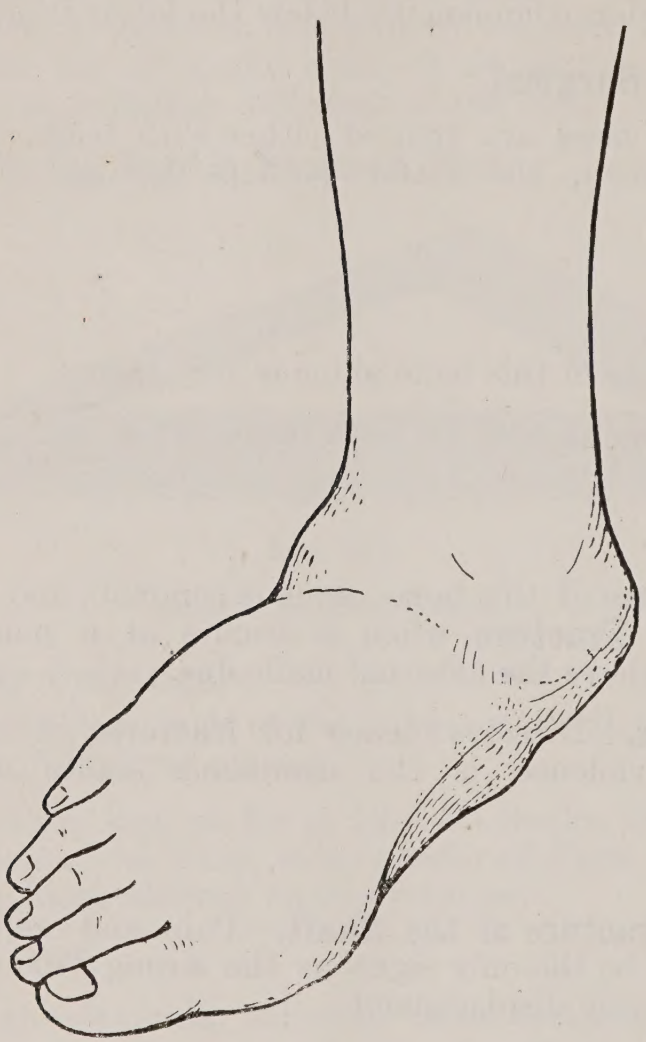

Fig. 113.

Deformity in Pott's Fracture.

(2) **Pott's Fracture.**—An anæsthetic is required to reduce the deformity, after which the

limb is put up in plaster-of-Paris, in a box splint, or in Cline's, Dupuytren's or Roughton's splints.

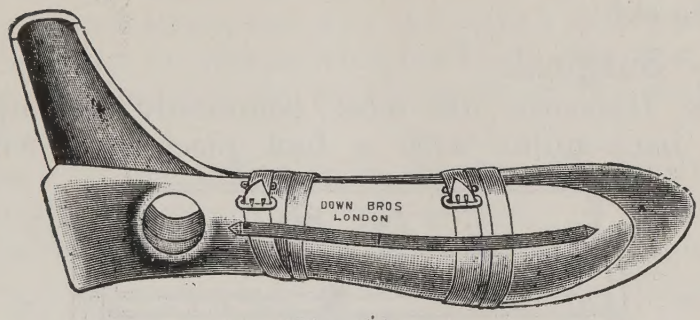

Fig. 114.
Cline's Leg Splints.

Fig. 115.
Dupuytren's Splint.

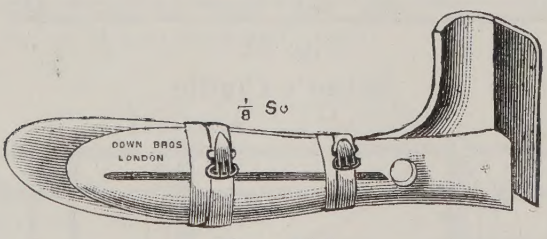

Fig. 116.
Roughton's Splints.

TIBIA AND FIBULA.

Fracture of both bones of the leg generally occurs at the junction of the middle and lower thirds of the limb, and is frequently compound.

Causes.—Direct or indirect violence.

Signs.—All the general signs of a fracture.

Treatment.

A.—First Aid.

Apply splints to the inner and outer sides of the leg, reaching from above the knee to just below the foot. Fix by bandages above and below the site of the fracture

and at the extremities of the splints. The feet may be tied together. The greatest care must be taken lest a simple fracture be made compound, as the Tibia lies just under the skin.

B.—Surgical.

These fractures are most commonly put up on a wooden back-splint with a foot piece, and with side

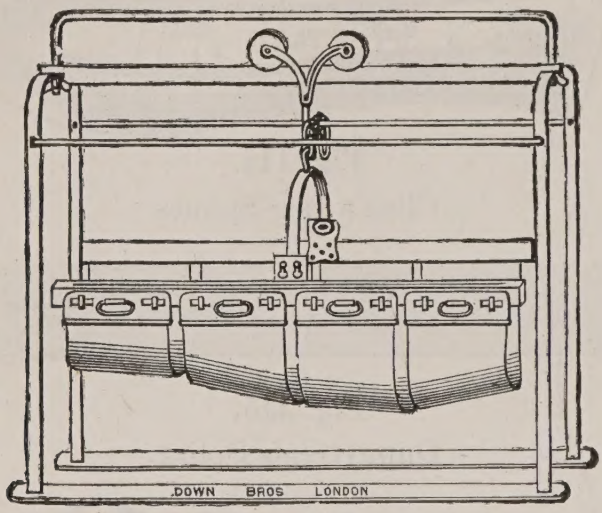

Fig. 117.
Salter's Cradle.

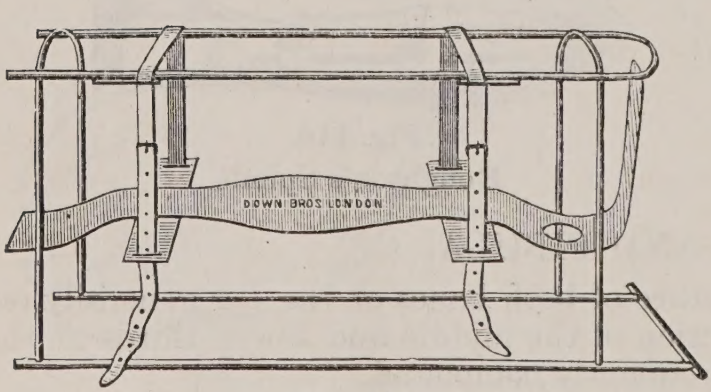

Fig. 118.
Neville's Splint and Lawrence's Cradle.

splints: the whole being raised on a pillow and steadied between sand bags, or slung in a Salter's or Lawrence's cradle. An anæsthetic will be required. Other splints used for these fractures are Guy's, Neville's and McIntyre's.

Sometimes plaster-of-Paris alone is used, in which case the still moist layers of bandage are cut down the front of the leg with a scalpel. When dry, the cut edges are bound with strapping and the splint is kept in place by bandages or by straps with buckles. By this method the plaster splint can be easily removed for massage of the limb

When there is difficulty in keeping the ends of the bones in place they are wired or plated.

These fractures take at least four weeks to unite.

TARSUS, METATARSUS AND PHALANGES.

Causes.—Direct or indirect violence.

Signs.—All the general signs of a fracture.

Treatment.

A.—First Aid.

Treat as for fracture of both bones of the leg.

B.—Surgical.

The treatment will vary according to the nature and position of the fracture. Encasing the foot in plaster-of-Paris is the commonest method.

DISLOCATIONS.

A dislocation is the displacement of a bone at a joint, the result of violence.

Causes. — Usually indirect violence, occasionally direct violence.

Varieties.

(1) Simple.
(2) Compound.
(3) Complicated.

These terms are used in the same sense as in the case of fractures.

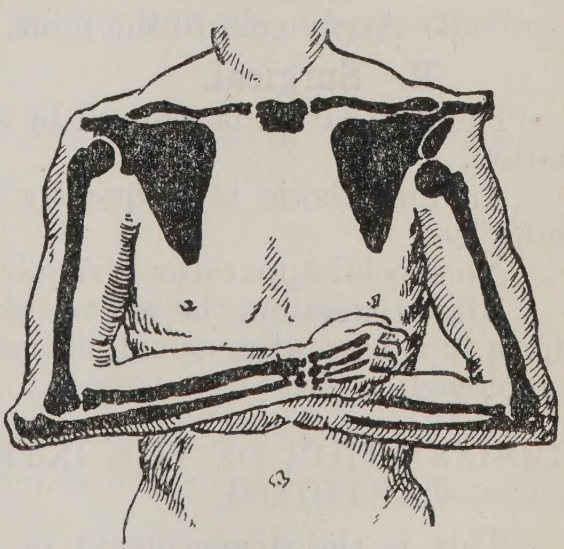

Fig. 119.
Dislocation of the Right Elbow and Left Shoulder.
(First Aid in the Royal Navy.)

Signs.

(1) The patient complains of

(*a*) **Pain.**

(*b*) **Loss of Power.**

(2) On looking at the part there will be seen

(*c*) **Swelling.**

(*d*) **Deformity.**

(3) On examination of the part there will be found

(*e*) **Decreased mobility.**

(*f*) **No crepitus.**

The pain in dislocations is very severe and may cause the patient to faint or vomit. The deformities comprise the presence of unnatural depressions and bony prominences, and the shortening or lengthening of the limb.

General Treatment.

A.—First Aid.

(1) Never attempt to reduce a dislocation.

(2) Place the part in a comfortable position and keep it at rest by means of bandages, and splints when necessary.

(3) Apply cold to the joint.

B.—Surgical.

The dislocation is reduced by extension or by manipulation.

An anæsthetic is frequently necessary to relax the muscles.

No special apparatus is required.

After reduction, the joint is kept fixed by bandages for a few days, after which massage and movements are employed.

DISLOCATION OF THE INTERNAL SEMILUNAR CARTILAGE.

This is the displacement of an important cartilage lying on the upper end of the Tibia in the interior of the knee joint, which is caused by violence when the knee is flexed, not uncommonly on the football field.

Signs.—There is sudden intense pain in the knee and inability to straighten the leg.

Treatment.

A.—First Aid.

Do not pull on the leg nor make any attempt to straighten it.

Obtain Medical assistance or remove the patient on a stretcher.

Cold may be applied to the joint.

B.—Surgical.

The cartilage is replaced by manipulation, with or without an anæsthetic, and the joint kept at rest for a few days.

This displacement is very liable to recur, in which case the cartilage is removed by operation.

SPRAINS.

A Sprain is caused by the forcible overstretching of the ligaments surrounding a joint.

Signs.

(1) Pain, which may be very severe and cause fainting or vomiting.

(2) Swelling.

(3) Discolouration of the skin, due to subcutaneous hæmorrhage.

Treatment.

A.—First Aid.

Keep the joint at rest by the application of splints and bandages. Apply cold water to the joint, or, if this does not ease the pain, hot fomentations may be tried.

B.—Surgical.

Massage, and the application of a firm bandage in the intervals.

Chapter VIII.

POISONS.

A poison is a substance which, when introduced into the system, or applied externally, injures the health, or destroys life. Poisoning may occur as the result of (*a*) an accident, (*b*) attempted suicide, or (*c*) attempted murder.

Accidental poisoning may be suspected when the symptoms come on suddenly soon after taking food, drink, or medicine. If the cause be poisonous food, several persons may be affected at the same time with similar symptoms.

Intentional poisoning may be suspected when there is found near the patient the bottle, glass, cup, or syringe from which the poison has been taken. A history of mental depression, insanity, or threats to commit suicide, may also be obtained.

Always save any bottle, glass, vomit, stained clothes, etc.

GENERAL TREATMENT OF POISONING.

1. **Remove as much of the poison as possible from the system.**—This may be done by :—

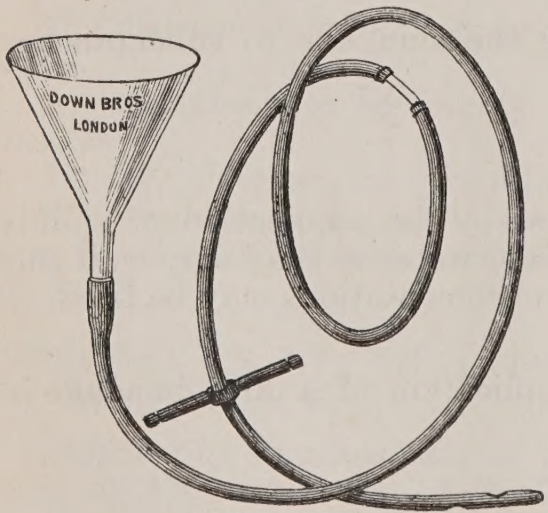

Fig. 120.
Stomach Syphon.

(*a*) **The Stomach Syphon.**—This consists of a plain rubber tube, like a large soft catheter, called Jaques' Œsophagus Tube No. 18, to which is attached an enamelled funnel. A wooden mouth gag, with a hole in the centre, through which the tube passes, is also

provided. The tube is lubricated with glycerine, and passed into the stomach, which is washed out in the way described under Irrigation of the Stomach.

(*b*) **The Stomach Pump,** which consists of a brass pump, with a two-way cock, to which flexible tubes are attached. One of these tubes is passed into the stomach, the other acts as a waste pipe. This apparatus is now obsolete, and need not be further described.

These apparatus must not be used in cases of poisoning by a corrosive.

(*c*) **Emetics,** which are agents causing vomiting. These can only be used if the patient is conscious and can swallow, and *must never be used in cases of poisoning by a corrosive.*

The chief emetics are :—

(1) Tickling the back of the throat with the finger or a feather.

(2) Large draughts of tepid water.

(3) One tablespoonful of mustard in a tumbler of tepid water.

(4) Two tablespoonsful of common salt in a tumbler of tepid water.

(5) Zinc sulphate, 30 grains in half a tumbler of water. *This must never be used if salt has already been given, because a corrosive poison—Zinc Chloride—will be formed.*

(6) Powdered ipecacuanha, 30 grains in half a tumbler of water.

(7) Ipecacuanha wine, 4 to 6 drams in water.

(8) Copper sulphate, 5 to 10 grains in water.

These must be given only by the Medical Officer :—

(9) Tartar emetic, 1 to 2 grains in water.

(10) Apomorphine, $\frac{1}{10}$ grain, given by hypodermic injection.

(*d*) **Purgatives.**—These act too slowly for the treatment of acute poisoning, but are used, nevertheless, in cases of poisoning by ptomaines and fungi. Castor oil, 1 ounce, is the best.

2. **Administer the proper antidote.**

Antidotes act either by converting the poison into an insoluble or harmless compound, or by neutralizing its effects in the body.

3. **Treat the special symptoms.**

For collapse give stimulants, and apply warmth.

Alcohol ʒ ss, ether ʒ j, or aromatic spirits of ammonia ʒ j, may be given in water; and hot strong coffee or beef tea by the mouth or rectum. Prepare a hypodermic syringe and strychnine.

For failing respiration, perform artificial respiration.

For pain, apply hot fomentations around the throat or over the stomach. Have morphia ready for hypodermic injection.

For inflammation of mucous membranes give demulcents, such as milk, white of egg mixed with milk or water, barley water, olive oil, or gruel.

CLASSIFICATION OF POISONS.

A.—Corrosives.

B.—Irritants.

C.—Narcotics.

D.—Narcotic-irritants.

A.—Corrosive Poisons are those which soften and destroy the parts with which they come in contact. They affect the mucous membrane of the mouth, œsophagus, and stomach, and may stain the lips and clothing.

The most important are :—

1. The Strong Acids.

Official Name.	*Common Name.*	*How recognised.*
Sulphuric acid	Oil of vitriol	Stains the skin brown or black.
Nitric acid	Aqua fortis	Stains the skin yellow.
Hydrochloric acid	Spirits of salt	Stains the skin white.
Acetic acid	——	Smells like vinegar.
Oxalic acid	Salts of lemon	Stains the skin white; resembles Epsom salts in appearance.
Carbolic acid	——	Stains the skin white; has a distinctive smell.

2. The Strong Alkalies.

Official Name.	*Common Name.*	*How recognised.*
Ammonia	Spirits of hartshorn.	Gives off a pungent vapour.
Liquor potassæ Caustic soda	——	These feel soapy when rubbed between the fingers.

Caustic soda is used by the engineers on board ship, and also to remove grease stains from the decks. It is a solid, supplied in tins, and is dissolved in water before use.

3. The Corrosive Salts of Metals.

Official Name.	*Common Name.*	*How recognised.*
Perchloride of mercury (in strong solution only).	Corrosive sublimate.	——
Zinc chloride	——	——
Silver nitrate	Lunar caustic	Stains the skin black, but not immediately.

General Symptoms of Corrosive Poisoning.

Intense burning pain in the mouth, œsophagus, and stomach; retching and vomiting, the vomit being blood stained, and containing shreds of mucous membrane; swelling of the tongue and mucous membrane lining the mouth; excessive flow of saliva; shock.

The patient may die from shock, suffocation, or perforation of the stomach.

General Treatment of Corrosive Poisoning.

1. Never use the stomach syphon or pump, nor give emetics.
2. Give the antidote as quickly as possible, followed by demulcents.
3. Treat the shock and pain.
4. Remember that tracheotomy may be necessary.

Special Antidotes.

Poison.	*Antidotes.*
Sulphuric acid Nitric acid Hydrochloric acid Acetic acid	Lime water or magnesia, washing soda, chalk, carbonate of soda, whitening, or soap, dissolved in at least one pint of water.
Oxalic acid	Magnesia, chalk, or whitening, dissolved in water. *Do not give soda, potash, or ammonia.*
Carbolic acid	Magnesium sulphate (Epsom salts), ℥ ss. in half-a-pint of water.
Ammonia Liquor potassæ Caustic soda	Vinegar, lemon juice, orange juice, dilute acetic acid, citric acid, tartaric acid.
Perchloride of mercury	Raw white of egg mixed with water, flour and water, or barley water.
Zinc chloride	Carbonate of soda or washing soda in water; raw white of egg, strong tea.
Silver nitrate	Common salt, dissolved in water.

B.—IRRITANT POISONS are those which cause inflammation of the mucous membrane of the stomach and intestines.

The most important are :—

1. **Salts of Metals.**

Arsenic - -	Used in medicine, sheep-washes, rat pastes, weed killers, fly-papers, dyes, and in stuffing birds and animals.
Zinc - -	As zinc sulphate or white vitriol.
Antimony -	As tartarated antimony or tartar emetic.
Lead - -	As lead acetate or sugar of lead, lead carbonate or white lead, lead subacetate or Goulard extract, which forms the ordinary lead lotion.
Mercury -	As perchloride of mercury, in dilute solutions. It may be absorbed from large raw surfaces when used as an antiseptic.

2. **Organic Drugs.**

Cantharides, or Spanish fly.
Turpentine.
Croton oil.

3. **Poisonous Foods.**

Foods become poisonous by decomposition, the actual poisons being called *ptomaines*. Ptomaines are most commonly found in pork and meat pies, sausages, and shell fish ; but milk, cheese, butter, ice-cream, fish, and vegetables may also be affected.

4. **Fungi.**

There are some poisonous fungi which closely resemble edible mushrooms.

General Symptoms of Irritant Poisoning.

The symptoms do not come on for some time—often hours—after the poison has been taken. Nausea, faintness, colicky pains in the stomach, violent and persistent vomiting, diarrhœa, and collapse.

General Treatment of Irritant Poisoning.

1. Emetics, or the stomach syphon, are used if the vomiting has not been very free.
2. Give a purgative—castor oil, 1 oz. Most of the poison may have passed into the intestines before the symptoms occur.
3. Give the antidote.
4. Relieve the pain by hot fomentations.
5. Treat the shock.

Special Antidotes.

Poison.	*Antidotes.*
Arsenic	*Dialysed iron or magnesia.
Zinc sulphate	Carbonate of soda, strong tea.
Antimony	Strong tea or coffee.
Lead	Sulphate of magnesium ℥ ss.
Mercury	Raw white of egg.
Cantharides	Demulcents. *No fats or oils.*
Turpentine	Sulphate of magnesium ℥ j. Demulcents.
Croton oil	*Spirit of camphor ♏ x, in milk or on sugar.
Ptomaines	None. General treatment only.
Fungi	*Tincture of belladonna ♏ xx, in water.

C.—Narcotic Poisons are those which act on the nervous system, producing drowsiness, sleep, and coma.

The most important are :—

Opium and morphia, chloral, prussic acid, belladonna, alcohol, and the poisonous gases.

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* *These antidotes are not to be given in First Aid Treatment; in fact, they may not be procurable. In Hospital, or in a Ship, the Medical Officer will have charge of the case.*

OPIUM.

This drug is met with in medicine in the following forms :—

Pulvis opii or powdered opium.
Tinctura opii or laudanum.
Tinctura camphoræ co. or paregoric.
Pulvis ipecacuanhæ cum opio or Dover's powder.
Pulvis creta aromat. c̄ opio.
Pil. plumbi c̄ opio.
Pil. saponis co.
Unguentum gallæ c̄ opio.
Morphinæ sulphas.
Liquor morphinæ hydrochloridi.
Chlorodyne.

Symptoms.

These come on in from a few minutes to some hours, according to the amount taken and the method of administration. They occur more rapidly after a hypodermic injection than when taken by the mouth.

At first the patient is mildly excited. He complains of headache and giddiness, becomes drowsy and finally insensible.

At this stage the breathing is slow and stertorous; the skin cold, pale, and bathed in sweat; the lips and extremities blue; and the pulse feeble. The muscles are relaxed, so that the limbs hang limp. One of the most important signs is the small size of the pupils, so small that they are called "*pin-point*" *pupils*. Death when it occurs is due to asphyxia.

Treatment.

If the patient is already unconscious, the stomach syphon is used, and the stomach thoroughly washed out with potassium permanganate (20 grains to the pint).

If the patient is conscious, give mustard and water as an emetic, and keep him awake by sprinkling cold water on his face, and by walking him about. To do this properly two attendants are necessary, one on either side. Do not continue this if he becomes unconscious or much fatigued.

When the breathing shows signs of failing commence artificial respiration.

Hot strong coffee injected slowly into the rectum is the best stimulant.

CHLORAL HYDRAS.

This is used as the pure salt (dose 5 to 20 grains), or in the form of syrup of chloral ($\frac{1}{2}$ to 2 drams). Poisoning often occurs by taking an overdose in a sleeping draught.

Symptoms.

The patient soon becomes unconscious. The skin is cold and moist; the face dusky; the pulse feeble; the respirations slow; and the smell of chloral may be detected in the breath. Death occurs from heart failure.

Treatment.

Empty the stomach by the syphon or by emetics. Keep the patient awake, but *do not walk him about.* Stimulate him by warmth, and by hot coffee per rectum.

HYDROCYANIC ACID or **Prussic Acid.**

Symptoms.

Insensibility occurs within a few seconds. The breathing is difficult and irregular; the pulse feeble; the skin cold and clammy; the eyes staring; and the smell of "bitter almonds" may be detected in the breath. Most cases are fatal.

Treatment.

If there is time, empty the stomach. As the symptoms come on so quickly this is often a waste of time, so commence artificial respiration at once and apply warmth. Cold water to the face is useful.

BELLADONNA.

With this is included **Atropine.**

Symptoms.

These commence with dryness of the throat and delirium (talking and laughing), followed by insensibility. The pulse is feeble, the skin dry, and the pupils dilated.

Treatment.

Empty the stomach and give stimulants, of which strong tea is the best.

ALCOHOL.

This poison is dealt with later.

POISONOUS GASES.

The chief poisonous gases are :—

Chloroform.	Coal gas.
Ether.	Gasoline.
Carbon monoxide.	Choke damp and after damp.
Carbon dioxide.	Sewer gas.

Chloroform and Ether have been described in the chapter on Anæsthetics, with the symptoms and treatment of an overdose. Chloroform may be swallowed, in which case the stomach must be emptied.

Carbon Monoxide and Carbon Dioxide.

These gases occur in enclosed spaces, such as double bottoms of ships and unventilated store rooms. They are also produced by combustion and explosions.

Symptoms.

There is headache and giddiness, nausea and difficulty in breathing, followed by drowsiness and insensibility. In some cases insensibility and death are almost instantaneous.

Coal Gas, Choke Damp and After Damp owe their symptoms to the carbon monoxide and carbon dioxide present.

Gasoline is now largely used to drive the engines in submarines, and the vapour may escape and cause

poisoning. The symptoms are:—mild excitement (like alcoholic intoxication), followed by depression and stupor.

Treatment.

Remove the patient immediately to the fresh air and commence artificial respiration. Encourage the circulation by rubbing the limbs and give inhalations of oxygen if it is available.

D.—NARCOTIC-IRRITANT POISONS are those which act on the nervous system, producing convulsions and delirium, followed in some cases by coma. They are irritant to the brain and spinal cord—*not the stomach.*

The most important are strychnine, phosphorus, aconite, and alcohol.

STRYCHNINE.

This is obtained from nux vomica and is much used in medicine. It is also contained in most "vermin killers."

Symptoms.

The patient may complain of the intensely bitter taste of the poison. The muscles begin to twitch, and then tonic convulsions set in, lasting about a minute and alternating with periods of relaxation. During the attack the hands and jaws are clenched, the body rigid and often arched, and the eyes wild and terror-stricken. The patient does not lose consciousness, and death occurs from asphyxia or exhaustion.

Treatment.

If possible the stomach should be emptied, but this is very difficult as any attempt to swallow may cause the convulsions.

To prevent this, the Medical Officer may anæsthetise the patient with chloroform or give a dose of chloral.

In the later stages artificial respiration must be performed.

Stimulants must *not* be given.

PHOSPHORUS.

This drug can be easily obtained in the form of matches or rat paste.

Symptoms.

The patient may complain of the garlic-like taste. After an interval, pain in the stomach and vomiting may occur—the vomit being luminous in the dark. The other symptoms resemble those caused by an irritant poison.

In most cases partial recovery takes place, and then about the third day jaundice, diarrhœa, enlargement of the liver, and distension of the abdomen occur. These symptoms are followed by delirium, coma, and death.

Treatment.

Empty the stomach. Give copper sulphate gr. 3 in a tumblerful of water, followed by magnesium sulphate oz. ½. Demulcents may also be given, but *avoid all oils and fats* as they dissolve phosphorus and so it is more easily absorbed.

ACONITE.

The drug may be taken in poisonous doses, or the plant from which it is obtained may be eaten in mistake for horseradish.

Symptoms.

There is pain in the stomach and vomiting at first, with numbness and tingling of the tongue and mouth. The pulse is feeble; breathing very difficult; the skin cold and clammy; and the limbs are convulsed.

Treatment.

Empty the stomach, apply warmth, and give stimulants.

ALCOHOL POISONING.

Alcohol is a common and important poison and is best described separately, as the symptoms vary according to the stage. Thus, in the earliest stage it may act

as an irritant, later as a narcotic-irritant, and finally as a narcotic only.

Acute Alcoholism.

In the early stages there is excitement, varying in degree from the talkative condition to acute mania. Following this the patient loses control of his muscles and speech, so that he staggers in his gait and slurs his words. Then comes the stage of stupor, drowsiness, and possibly coma. Delirium and convulsions are not uncommon.

Treatment.

Empty the stomach, put the patient to bed, and keep him warm. If the breathing is difficult perform artificial respiration.

Hot coffee given by the rectum is the best stimulant.

Delirium Tremens.

This is a condition of delirium which occurs after a heavy drinking bout in men who regularly indulge in alcohol.

Symptoms.

The patient is delirious, muttering to himself, and often violent. He has hallucinations, the commonest objects being rats, spiders, or reptiles of marvellous colours. The tongue, lips, and hands are very tremulous and he does not sleep. He may have some fever; his tongue and mouth are dry and dirty; there is considerable difficulty in getting him to take food and to stay in bed.

The disease lasts for from three to five days and is always serious, but especially so when it occurs with other diseases, such as pneumonia and enteric fever. Severe injuries in an alcoholic subject often determine the onset of delirium tremens.

Treatment.

The patient is put to bed in a darkened room. Two nurses are required, day and night, to restrain violence and to keep him in bed. By placing a sheet, folded like

a draw-sheet, over the legs and hips, and tucking the ends well in under the mattress, the lower limbs can be restrained without risk of injury, and the nurses can then attend to the arms. Avoid pressure on the chest, and do not struggle with the patient—allow him limited freedom. Feeding is most important. Beef tea, milk, and eggs are given in small quantities frequently.

The Medical Officer will order some sedative or hypnotic, as sleep is urgently required.

Chronic Alcoholism.

The constant drinking of alcohol may cause changes in various organs without the patient showing signs of intoxication.

The most common of these conditions are :—

Dulness of intellect.
Tremor of the muscles.
Chronic dyspepsia.
Neuritis.
Cirrhosis of the liver.
Aneurysm.

Chapter IX.

ASPHYXIA.

Asphyxia is the condition in which the function of respiration is interrupted. The result is that no interchange of gases takes place in the lungs and the patient suffers from Carbon Dioxide poisoning.

Causes.

(1) Obstructions to the free passage of air through the air passages (pharynx, larynx, and trachea) by—
   - (*a*) Foreign Bodies—as in choking;
   - (*b*) Suffocation—where the obstruction is over the nose and mouth;
   - (*c*) Compression of the trachea — as in strangulation;
   - (*d*) Injury or Disease—as in scalds of the throat and Diphtheria.

(2) Immobility of the chest walls and diaphragm, due to—
   - (*a*) Spasm of the Muscles—as in Strychnine Poisoning, Tetanus, and Hydrophobia;
   - (*b*) Compression by heavy weights—such as falls of earth or sand.

(3) Submersion in a liquid—as in drowning.

(4) Interference with the nerve supply to the muscles of respiration, due to—
   - (*a*) Injury or disease of the brain or spinal cord;
   - (*b*) The action of poisons—such as Opium, Chloroform, Prussic Acid, Poisonous Gases;
   - (*c*) Electric shock.

Symptoms.

The respirations cease; the face becomes dark blue in colour (*cyanosis*); consciousness is lost; after about four minutes the heart stops beating.

General Treatment.

(1) Remove the cause if possible.
(2) Loosen all tight clothing round the neck and chest, also undo the braces and the top buttons of the trousers.
(3) Pull the tongue forward and keep it there. The best method is to get an assistant to grasp the tongue in a handkerchief between the finger and thumb. If no assistant is available, pass a narrow piece of bandage, strip of linen, or an elastic band over the tongue as far back as possible and tie under the jaw.
(4) Perform artificial respiration. By this is meant an imitation of the normal movements of respiration.
(5) Promote the warmth of the body and stimulate the circulation.

METHODS OF PERFORMING ARTIFICIAL RESPIRATION.

1. Schäfer's Method.

Lay the patient on his face; support his forehead on his forearm to keep his nose and mouth clear of the ground; place a pillow or roll of clothing under the

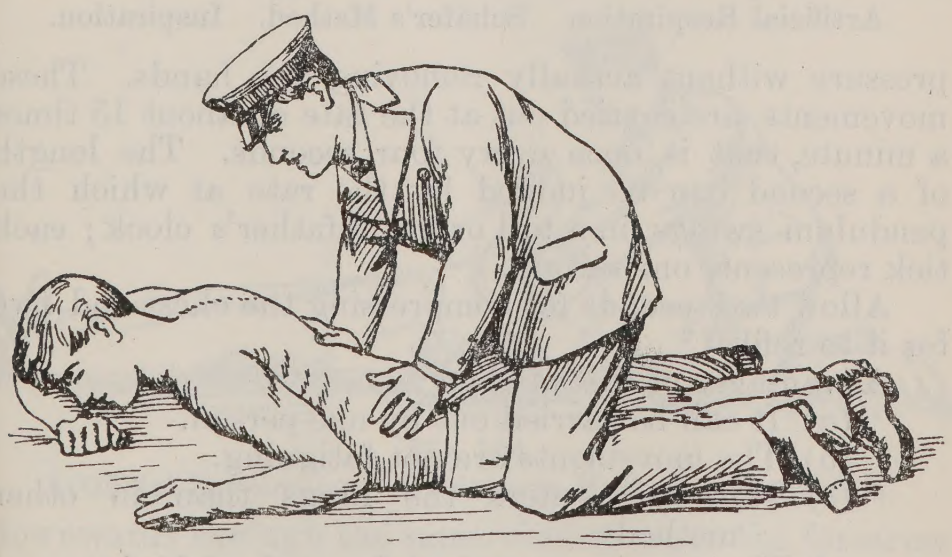


Fig. 121.
Artificial Respiration. Schäfer's Method. Expiration.

lower part of his chest, and see that the tongue is well forward. Kneel astride him facing his head, and place the hands with outspread fingers over the lower ribs. Compress the chest by throwing the weight forward on to the hands, then allow the chest to fill by springing back into the upright kneeling position and relaxing the

Fig. 122.

Artificial Respiration. Schäfer's Method. Inspiration.

pressure without actually removing the hands. These movements are carried out at the rate of about 15 times a minute, that is, once every four seconds. The length of a second can be judged by the rate at which the pendulum swings in a tall or grandfather's clock; each tick represents one second.

Allow two seconds for compressing the chest and two for it to refil.

Advantages of this method :—

(*a*) It can be carried out by one person.

(*b*) The movements are not fatiguing.

(*c*) More air enters the lungs than in other methods.

(*d*) The tongue remains forward and does not require holding.

2. Sylvester's Method.

Lay the patient on his back and place a pillow or roll of clothing under the shoulders, so that the head hangs downwards. Pull the tongue well forward and fix it there, or get an assistant to hold it. Kneel at the patient's head and grasp his arms just above or just

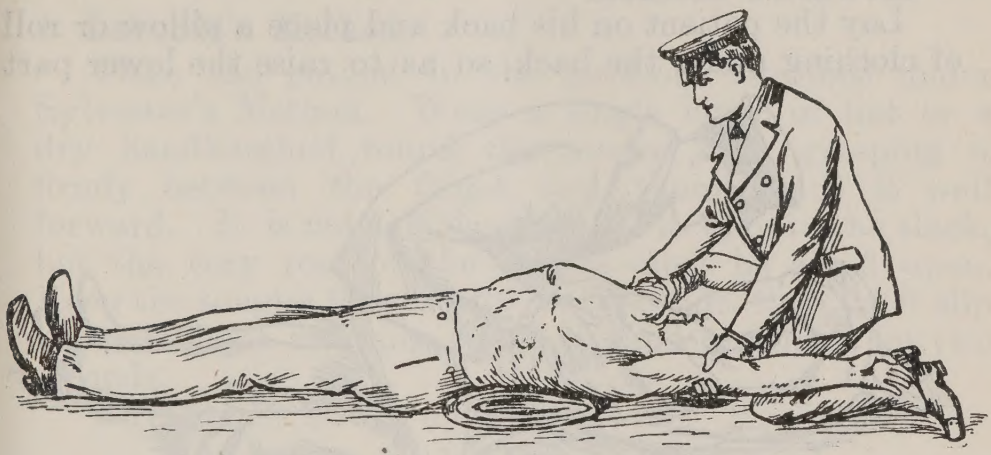


Fig. 123.
Artificial Respiration. Sylvester's Method. Inspiration.

below the elbows, whichever is the more convenient. Sweep the arms upwards from the sides to above the head, keeping the elbows near the ground during the whole movement. This tends to fill the lungs with air and should occupy two seconds. Now sweep the arms

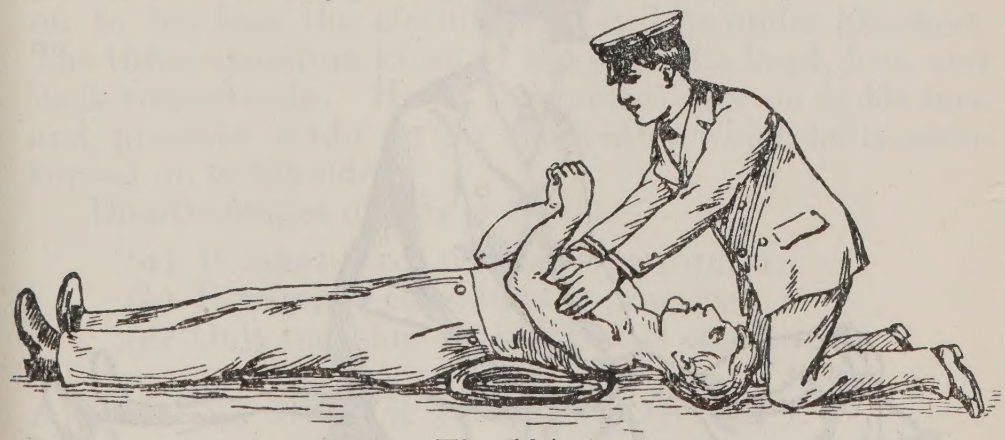


Fig. 124.
Artificial Respiration. Sylvester's Method. Expiration.

downwards through the same circles, cross the forearms over the body and, by leaning forwards, compress the sides and front of the lower ribs. This movement should also occupy two seconds.

Disadvantages of this method :—

(*a*) The movements are somewhat fatiguing.

(*b*) The tongue must be drawn forwards and fixed.

(*c*) A certain amount of space is necessary for the sweeping movement of the arms.

3. Howard's Method.

Lay the patient on his back and place a pillow or roll of clothing under the back, so as to raise the lower part

Fig. 125.

Artificial Respiration. Howard's Method. Expiration.

of the chest. Kneel astride the patient, place his hands above his head, and proceed as in Schäfer's Method.

Fig, 126.

Artificial Respiration. Howard's Method. Inspiration.

The pressure will now, however, be on the front and sides of the chest. Do not press on the pit of the stomach.

This method, like Schäfer's, may be used when there is some injury to the arms.

4. **Laborde's Method.**

Place the patient in the position described under Sylvester's Method. Wrap a single layer of lint or a dry handkerchief round the tongue and, grasping it firmly between the finger and thumb, pull it well forward. It is not sufficient merely to take in the slack, but the very root of the tongue must be acted upon. Keep the tongue forward for two seconds, then let it slip back (without relaxing the hold) and remain so for two seconds.

Advantages of this method :—

(*a*) It can be employed in cases where the arms or ribs are injured.
(*b*) It is especially useful in children.

5. **Marshall Hall's Method.**

This requires three people. Lay the patient on one side and under his chest place a roll of clothing, which must be sufficiently long that when the patient is rolled on to his face the clothing will still be under his chest. The three operators kneel at the patient's head, feet, and back respectively. He is then rolled over on to his face and pressure made on his back, after which he is again turned on to his side.

Disadvantages of this method :—

(*a*) It takes three people to perform it.
(*b*) It requires considerable practice.
(*c*) Only one side of the chest is acted upon.

APPARENT DEATH FROM DROWNING.

1. Appearance when removed from the water.

The body is cold; the face swollen and cyanosed; the lips blue; the hands and feet swollen; frothy fluid, often streaked with blood, is found in the mouth and nostrils; there is water in the stomach and lungs.

2. Treatment.

(*a*) **Clear the air passages** of weeds, mud, mucus, &c., and remove all tight clothing around the neck, chest, and abdomen.

(*b*) **Drain the Stomach** of water. Turn the patient on his face; then, standing astride him, clasp

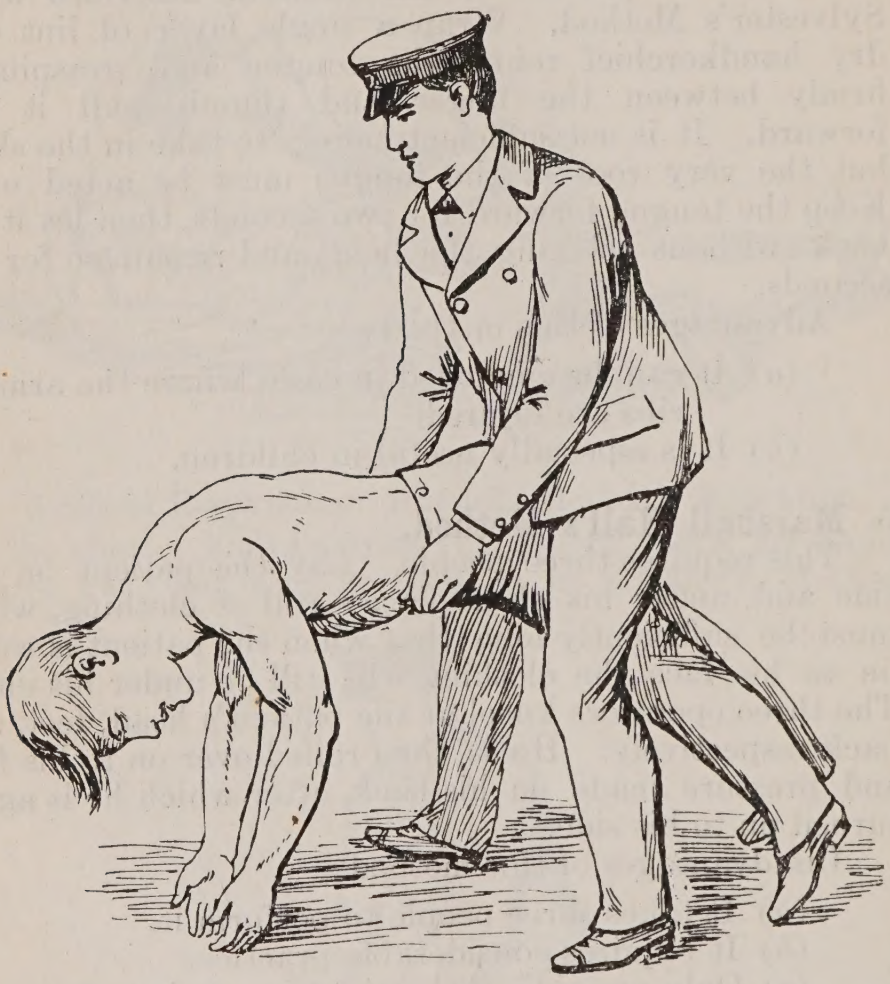


Fig. 127.
Draining the Stomach.

your hands under his stomach and raise his body.

These preliminaries must not occupy more than a few seconds.

(*c*) After placing the body in the requisite position, **commence artificial respiration.** This must be continued for at least an hour, even after the heart has stopped beating.

(*d*) **Promote warmth and circulation.** Assistants are in the meantime instructed to strip off the wet clothing, dry the body, and cover it with warm dry blankets or dry clothing. They must then rub the limbs vigorously, taking care to rub towards the heart. Hot bottles or bricks wrapped in flannel or clothing are packed around the body and legs.

(*e*) When breathing has been restored, and the patient is conscious and able to swallow, **give stimulants** and warm drinks. These must be given in very small quantities and may consist of brandy or whisky and water, hot milk, beef tea, or coffee.

The treatment so far should be carried out as near the place of accident as possible.

(*f*) Remove the patient to **shelter,** place him in bed and encourage sleep. Watch the breathing, and if it again tends to fail, recommence artificial respiration.

(*g*) Careful **after-treatment** is necessary, as pneumonia is very liable to occur.

CHOKING.

Asphyxia due to choking is caused by foreign bodies passing into the larynx. These may be pieces of food, false teeth, coins, fruit stones, &c.

Treatment.

(*a*) Place the patient on his back with his head turned to one side.

(*b*) Try to hook out the foreign body with the finger passed well back over the base of the tongue.

(*c*) When the obstruction has been removed perform artificial respiration if the breathing has ceased.

STRANGULATION.

This may occur when the body is suspended by the neck in attempted hanging, or when a cord or other material is tied tightly round the neck.

Treatment.

(*a*) Immediately cut or loosen the cord, &c.

(*b*) If the breathing has ceased, commence artificial respiration.

The treatment of asphyxia due to other causes is dealt with elsewhere.

Chapter X.

INSENSIBILITY AND FITS.

Insensibility, or unconsciousness, arises from a number of causes, but all take effect by interfering with the function of the brain. Thus, it may be due to anæmia, laceration, shaking, or disease of the brain; pressure on the brain; the action of poisons, heat or electricity; or to mental excitement.

SYNCOPE.

The common name for this is "fainting," and it is produced when there is an insufficient supply of blood to the brain.

Causes.

Exhaustion, want of food, pain, hæmorrhage, or a foul atmosphere are common causes of fainting. It may follow various emotions, such as fear, grief, joy, or a painful sight; and also frequently occurs in heart disease.

Symptoms.

In some cases insensibility comes on suddenly and the patient falls to the ground without warning. In other cases he complains of giddiness and nausea, the face becomes pale, he breaks into a cold sweat and then falls unconscious.

The pulse is feeble and irregular, and the respirations quiet.

The attack usually lasts only a few minutes.

Treatment.

Place the patient flat on his back with the head low.

Loosen all tight clothing—the tie, collar, shirt, braces, &c.

Allow plenty of fresh air—open the windows and doors, and prevent crowding around the patient.

Sprinkle cold water on the face and apply smelling salts (ammonia) to the nostrils.

If a man complains of feeling faint, take him into the open air and allow him to lie down. If seated in a crowded room, make him separate his knees and force his head down between them; but this must never be done when the man is already unconscious.

SHOCK.

Shock, or collapse, is conveniently described here although insensibility does not usually occur.

Causes.

(1) Severe Injuries,
  (*a*) affecting large surfaces—such as extensive burns and scalds;
  (*b*) affecting the viscera—lungs, intestines, liver, &c.;
  (*c*) causing much tearing or crushing of the tissues.
(2) Excessive Hæmorrhage.
(3) Prolonged Surgical Operations.
(4) Certain Poisons, chiefly the Corrosives and Narcotic-irritants.
(5) Intestinal Obstruction.
(6) Perforation of the Stomach or Intestines.
(7) Profuse Diarrhœa.

Symptoms.

These may come on suddenly or very gradually. The face is pale; the skin cold and moist; the pulse small, feeble, and irregular; the respirations shallow and sighing; the pupils dilated; the eyelids drooping; and the temperature sub-normal. The patient is conscious and quite aware of what is going on around him, but is incapable of any movement. Remember that he is suffering from thirst but makes no complaint.

Finally he may die, or reaction takes place. In the latter case the body becomes warmer, the pulse improves and he may vomit.

Treatment.

First Aid.

Ascertain and treat the cause. Thus, if due to hæmorrhage, arrest it; if to poisoning, apply the appro-

priate remedies. Rest and warmth are absolutely necessary. Cover the patient with warm blankets and apply hot water bottles. Keep the head low and raise the feet. Give sips of hot milk, tea, or soup.

Surgical.

Rest *in bed* and warmth as above.

Remove all pillows from under the head, and raise the foot of the bed on blocks or chairs.

Prepare a hypodermic syringe, as the Medical Officer will probably order an injection of strychnine, ether, brandy, or morphia.

Saline infusions into a vein, into the subcutaneous tissues, or into the rectum are usually administered, and are described under Hæmorrhage (page 127).

With regard to food and stimulants by the mouth, definite orders will be given.

Moisten the lips frequently, and give sips of hot water to relieve the thirst.

CONCUSSION OF THE BRAIN.

The common name for this is "stunning," and it is due to severe shaking of the brain substance, the result of a blow or a fall.

Symptoms.

These vary considerably according to the severity of the case. The accident may result only in slight giddiness, followed by a headache, or the patient may be insensible for several days.

In the more severe cases the attack may be divided into four stages:—

(*a*) **Collapse.**—The patient becomes *suddenly* unconscious as the result of the blow or fall. The face is pale; the hands and feet cold; the pulse feeble, rapid, and irregular; and the respirations so shallow that in many cases the patient appears to be dead. This stage lasts for from $\frac{1}{2}$ to 3 hours.

(*b*) **Reaction.**—He moans, turns on one side, and draws up his knees. He can now be roused

sufficiently to answer questions, and vomiting often occurs.

(*c*) **Drowsiness.**—This stage may last for from one day to a week or even longer. The pulse and respirations are now stronger, and the skin is warm. He can be roused for food and by the calls of nature, but is often irritable when disturbed.

(*d*) **Convalescence.**—At first he is sleepy and irritable, and may suffer from headache, but gradually returns to health. Remember that in concussion there is no paralysis, and the pupils are equal; also that compression of the brain may have been caused at the same time, in which case the signs of the latter will develop as those of concussion pass off.

Treatment.

First Aid.

The patient is kept quiet; warmth is applied to the body and cold to the head. Give nothing by the mouth during the stage of collapse without orders.

Surgical.

The patient is kept quiet in a darkened room, while warm blankets and hot water-bottles are applied to the body. Stimulants may be ordered to be given by the mouth or by hypodermic injection. A dose of Calomel or Croton Oil is also usually ordered. Food is of little importance at first, and later the patient can usually be roused sufficiently to take it by the mouth. It should consist of fluids.

COMPRESSION OF THE BRAIN.

The symptoms of this condition are due to pressure on the brain as the result of injury or disease.

Causes.

(1) **Injury.**

(*a*) Depressed fracture of the skull.

(*b*) Blood clot, the result of hæmorrhage.

(2) **Disease.**

(*a*) Tumour growing on the brain.

(*b*) Abscess of the brain.

Onset.

This may be sudden or very gradual. When due to depressed fracture, insensibility may come on at once; when due to hæmorrhage, in a few hours; while in cases due to disease, it may not occur for several days or weeks.

Symptoms.

When due to injury, there will be a history or definite signs of the accident; while in other cases the patient will have been under observation in the ward for some time.

The patient is insensible and can *not* be roused. His face is flushed, the skin hot, the pulse full and slow, respirations stertorous, the pupils are generally unequal and paralysis is present. The paralysis is not general, but affects only one side, one limb, or one group of muscles.

Treatment.

First Aid.

If there is a wound of the head, dress it.

Undo all tight clothing.

Put the patient to bed with the head slightly raised.

Apply hot bottles to the feet, and cold to the head.

Give nothing whatever by the mouth.

It is important that Medical assistance should be obtained as soon as possible.

Surgical.

The general principles mentioned above are carried out, the actual treatment depending upon the cause of the compression. In any case, the skull is opened by the operation of trephining and an attempt made to relieve the pressure.

APOPLEXY.

This is due to the rupture of a small artery in the brain as the result of disease and *not of injury.* It

usually occurs in men over 50 years of age and is commonly called a "stroke."

Cause.

The artery itself may be diseased as the result of syphilis, or the pressure of the blood may be increased by chronic nephritis or heart disease and so cause the rupture. The attack may be brought on by sudden exertion or excitement.

Symptoms.

These are the same as in compression of the brain. but always come on suddenly. Paralysis of the whole of one side of the body occurs, and is well marked in the face. The fit may commence with convulsions of that side.

Complete or partial recovery from the first attack is common, but the third attack usually results in death. Months or years may elapse between the attacks.

Treatment.

First Aid.

Treat as for compression of the brain.

Medical.

Rest in bed, warmth to the body, and cold to the head, which should be slightly raised. A dose of Calomel or Croton Oil is usually given. An operation is never performed as in compression, because the arteries are diseased and the hæmorrhage occurs in the brain substance and not on the surface.

EPILEPSY.

This is a disease of the nervous system, but the cause has not been discovered. It nearly always commences before the age of 20, and consists of sudden attacks of unconsciousness, called "Epileptic Fits." These fits occur at irregular intervals throughout the patient's life.

Symptoms.

The onset is sudden, and occurs without any apparent cause. In most cases the patient receives a short warning called an *aura*, which may take the form of tingling

sensations, flashes of light, noises in the ears, or twitching of the muscles; and immediately afterwards he falls unconscious, making no attempt at self protection.

The Epileptic Fit may be divided into three stages.

(1) **The Stage of Tonic Convulsions.**

The arms and legs are flexed, the hands and jaw clenched, and, if the tongue is protruded when the fit commences, it will certainly be bitten. The eyes may squint.

This stage lasts only a few seconds.

(2) **The Stage of Clonic Convulsions.**

The limbs are thrown about in irregular movements, the jaws open and shut, frothy saliva escapes from the mouth, and the eyes may roll. The tongue may escape between the teeth and be bitten. Urine and fæces are often passed involuntarily. The face, which is often pale just before the fit, now becomes blue from interference with the respiration, which is stertorous.

This stage lasts from 1 to 3 minutes.

(3) **The Stage of Stupor.**

When the convulsions cease, the patient is usually very drowsy, and may even fall into a deep sleep which may last for hours. The breathing becomes less noisy and the cyanosis of the face passes off. He often awakes with a headache.

There are two recognised degrees of Epilepsy, that described above being called **Major Epilepsy** or **Grand Mal.**

Minor Epilepsy or **Petit Mal** is not accompanied by convulsions.

The patient loses consciousness only for a moment, usually he does not fall, and the stage of stupor is absent.

Status Epilepticus.

The "epileptic state" is the name given to a condition in which the patient has a series of fits lasting several hours or even days. As a rule he does not regain consciousness between the fits, and usually dies from exhaustion.

Post-epileptic State.

This name is given to a condition in which the patient performs acts unconsciously after recovering from the fit. Thus he may undress himself, collect and pocket the property of others, strike or even kill anyone standing near. He has no recollection afterwards of what he has done.

Treatment of Epilepsy.

As nothing can be done to cut short or prevent the attack, efforts can only be made to protect the patient from injury.

(1) Remove the patient from immediate danger. Pull him away from the fire, the walls, or from heavy furniture.

(2) Remove light furniture, so as to leave a clear space around him.

(3) Loosen all tight clothing and allow as much fresh air as possible.

(4) Protect his tongue from being bitten by introducing something solid between his teeth. This can only be done during the second stage, when his jaws relax. A piece of wood, the handle of a spoon, or a spatula may be used.

(5) Do not try to hold the patient down or to prevent the movements.

(6) After the fit, remove the patient to bed, keep him warm, and allow him to sleep.

(7) Never leave the patient until he has fully regained consciousness. Remember the Post-epileptic State.

Between the attacks Potassium Bromide is usually given.

Epileptics are always invalided from the Service for two reasons :—

(1) They may fall from aloft or into the sea during a fit.

(2) They may have a fit while performing some important duty and so endanger the ship or the lives of others.

HYSTERIA.

This disease is not accompanied by unconsciousness, but it is convenient to describe it here.

Hysteria may be described as a disease of the nervous system resulting in loss of will power. It is commonest among young females, but also affects boys.

Symptoms.

These vary considerably, no two hysterical fits being exactly alike. Almost every form of nervous disease may be imitated, but they usually resemble Epilepsy. They never occur when the patient is alone.

The onset is gradual, and can generally be traced to some emotion, such as anger or fear. The patient falls carefully and is never hurt. The limbs are thrown about irregularly or held in a state of muscular contraction, but not in the regular order seen in Epilepsy. He moans or cries during the fit, which lasts for many minutes. The tongue is never bitten nor are urine or fæces ever passed.

Treatment.

The chief point is firmness. Get rid of all sympathising friends if possible—send them to make coffee, or on some such errand. Talk firmly to the patient and threaten with cold water if the fit does not stop. If this has no effect, cold water is applied *freely* to the face.

Remember, however, that Hysteria is an actual disease and not the result of mere obstinacy on the part of the patient.

SUNSTROKE and HEATSTROKE.

Heat, either from the sun or from artificial sources, may cause syncope or coma. The symptoms may come on during or after the exposure to heat.

(1) **Sunstroke** commences with delirium, but coma soon occurs, and the symptoms somewhat resemble those of apoplexy.

The face is flushed, the skin hot and dry, the pulse quick, and respirations stertorous. The temperature of the body is very high—108°, or even higher.

(2) **Heatstroke** occurs suddenly with all the symptoms of syncope.

Treatment.

The application of ice or cold water to the body is carried out as quickly as possible after removing the patient from the heat. When consciousness returns stimulants are necessary.

ELECTRIC SHOCK.

This may be due to artificial or natural electricity (lightning), and the symptoms vary in severity according to the strength of the current.

Symptoms.

A slight shock may cause only temporary dizziness, which soon passes off. In severe cases, insensibility and convulsions are followed by cessation of respiration, or death may occur instantaneously.

Treatment.

Lightning Shock.

Warmth and artificial respiration. Dress any burns.

Electric Shock.

In this form nothing can be done until the patient has been removed from contact with the electric current. This may be done in several ways :—

(*a*) By turning off the switch. This should, of course, be done whenever possible.

(*b*) By short-circuiting the current. If the patient is in contact with two live wires, a bar of iron is dropped across them. Electricity always takes the shortest route, and it will pass from one wire to the other through the bar instead of through the patient's body. The bar is *dropped*, not placed, otherwise the rescuer will suffer.

(*c*) By removing the patient. Before touching the body, the rescuer must take steps to prevent himself receiving a shock. He must stand on some non-conductor of electricity, and similarly cover his hands. The best material is india-rubber, and, wherever electricity is largely used, thick indiarubber gloves are usually available. The best substitute is thick *dry* woollen clothing.

Having removed the patient from the source of danger, commence artificial respiration if necessary. Burns will require dressing.

In addition to the above-mentioned forms of insensibility, the following must also be kept in mind, and are described elsewhere :—

1. Uræmia.
2. Diabetic coma.
3. Narcotic poisons.

GENERAL TREATMENT OF INSENSIBILITY WHERE THE CAUSE IS UNKNOWN.

When a patient is found unconscious from an unknown cause proceed to treat and examine him as follows :—

(1) Place the patient on his back with the head on a level with the body.

(2) Undo all tight clothing and allow plenty of fresh air.

(3) Give nothing by the mouth until consciousness returns.

(4) Examine the body for injury, and treat any wound, fracture, or hæmorrhage which may be found.

(*a*) Excessive hæmorrhage, a fracture, or a severe wound suggest Syncope or Shock.

(*b*) A scalp wound suggests Concussion or Compression.

(5) Convulsions suggest Epilepsy or Hysteria.

(6) Paralysis suggests Compression or Apoplexy.

(7) The Skin is *hot* in Compression, Apoplexy, and Sunstroke.

The Skin is *cold* in Syncope, Shock, Concussion, and in Narcotic Poisoning.

(8) The Pupils are *dilated* in Shock and Alcohol Poisoning.

The Pupils are *contracted* in Opium Poisoning.

The Pupils are *unequal* in Compression and Apoplexy.

(9) The Pulse is *slow* in Compression and Apoplexy.

The Pulse is *quick* and *feeble* in all the other conditions.

(10) The Respirations are *stertorous* in Compression, Apoplexy, Epilepsy, and in poisoning by Alcohol and Opium.

They are *difficult* in Sunstroke and Electric Shock.

They are *shallow* in Syncope, Shock, and Concussion.

TABLE OF SYMPTOMS OF STATES OF

	Name.	Onset.	Insensibility.	Pulse.
1	Syncope - -	Sudden -	Complete -	Feeble and irregular.
2	Shock - -	Sudden or gradual.	Conscious -	,, ,,
3	Concussion -	Sudden -	Complete -	,, ,,
4	Compression -	Sudden or gradual.	,, -	Full and slow
5	Apoplexy -	Sudden -	,, -	,, ,,
6	Epilepsy - -	,, -	,, -	Feeble and quick.
7	Hysteria - -	Gradual -	Conscious -	No marked change.
8	(*a*) Sunstroke. (*b*) Heatstroke.	Sudden -	Complete -	Feeble and quick.
9	Electric shock -	,, -	,, -	Feeble - -
10	Alcohol poisoning.	Gradual -	Present in the later stages.	Feeble and irregular.
11	Opium poisoning.	,, -	Present -	Feeble and slow.

(11) If the patient's symptoms do not correspond with any of the above, the case is probably one of Uræmia or Diabetic Coma, and these are discovered by examination of the urine.

(12) Exhaustion, starvation, and deep natural sleep are worth bearing in mind.

Insensibility and Allied Conditions.

Respirations.	Skin.	Pupils.	Paralysis.	Convulsions.
Quick and shallow.	Cold, pale, and moist.	Equal	Absent - -	Absent.
Shallow and sighing.	,,	Dilated	,, - -	,,
Shallow -	Cold and pale.	Equal	,, - -	,,
Stertorous -	Hot and flushed.	Unequal	Present - -	Present in some cases.
,, -	,,	,,	Present on one side of the body and face.	Present.
,, -	Face cyanosed.	Equal	Absent -	Present—at first tonic, then clonic.
No marked change.	No marked change.	,,	,, - -	Irregular movements, not true convulsions.
Difficult—may cease altogether.	(*a*) Hot. (*b*) Normal.	,,	,, - -	Present.
,,	No marked change. May be burnt.	May squint.	May be present.	,,
Stertorous -	Cold and pale.	Dilated	Absent - -	Absent.
,, -	Cold, pale, and moist.	Contracted	,, - -	,,

Chapter XI.

GENERAL NURSING.

CARE OF WARDS.

To maintain a ward in an efficient state the following require constant attention :—

(*a*) Cleanliness.
(*b*) Ventilation.
(*c*) Temperature.
(*d*) Equipment.

(*a*) Cleanliness.

Every person—patient or nurse—and article in a ward must be kept scrupulously clean. Dirt is the soil in which germs grow and flourish, and the absence of dirt corresponds with a marked decrease in the number of germs and in the risks of infection.

The floors are wiped with a damp cloth morning and evening to collect the dust, and afterwards polished with Ronuk as necessary. The lighter articles of furniture must be moved and not dusted round, and also the bedsteads when the condition of the patient permits.

Every article of Furniture, tables, chairs, cupboards, &c., must likewise be dusted daily, and washed and polished regularly. The insides of drawers require special attention.

The windows must be kept clean. Sunlight is one of the best destroyers of germs that can be used.

Thewalls require dusting periodically and in some cases may be washed.

Bed- and body-linen must be changed when soiled; white coverlets are used because they show dirt more easily than coloured ones. No clothing must be kept in the ward except that belonging to patients allowed up. Their boots must be kept clean.

The nurse should be careful of his personal cleanliness. Dirty hands, a soiled gown, an unshaven chin, a

dirty collar, unbrushed hair, grease-stained trousers, or holed socks showing over torn ward slippers are the hall-marks of inefficiency.

Flowers tend to brighten a ward but must be removed at night and *before* they fade.

The ward annexes require especial attention. These consist of the pantry, bathroom, lavatory, sink and water-closet. The pan of the latter is liable to become soiled unless cleaned daily with the brush provided.

Brass work when well polished gives an appearance of brightness and cleanliness which is well worth the time spent on it.

Feeders should be cleaned by washing in hot water immediately after use. The lip requires special attention.

Spit pots should be cleaned once or twice daily, according to the amount of expectoration and the nature of the case. The under side of the lid must not be overlooked. Steeping in warm water helps to remove the sputum. Remember to give the patient another spit pot while cleaning the one last used. Keep a little carbolic lotion in the spit pot while in use.

Bed pans are cleaned, after emptying the contents, by inverting over an upright jet of water in the specially arranged sink. They must be emptied and cleaned immediately after use, except when the fæces are required for inspection by the Medical Officer or for disinfection. The underside of the half lid requires special attention.

Urinals or **goosenecks** must also be emptied and washed out immediately after use, except when the urine is required for examination or disinfection. When not in use they may be filled with water.

Wash bowls, basins and **receivers** are also to be cleaned immediately after use.

Table utensils, especially cutlery, must be kept bright and ready for immediate use.

Jugs and **cans** used for storing milk must be cleaned and then scalded with boiling water before being used

again. They must never be taken into the ward, and should be covered with clean white gauze.

(*b*) VENTILATION.

By ventilation is meant the removal of foul air and the supply of fresh air to take its place.

Air becomes foul in various ways :—

(1) By respiration, oxygen being consumed and carbon di-oxide exhaled.
(2) By combustion of coal and gas, the effect being the same as respiration.
(3) By dust.
(4) By germs.
(5) By heat.
(6) By moisture.
(7) By bad odours.

Each person exhales 16 cubic feet of carbon dioxide in 24 hours; a gas burner produces 2 cubic feet of CO_2 in an hour, and 1 lb. of coal when burning gives off about 3 lbs. weight of CO_2.

Dust, when inhaled in quantity, causes inflammation of the lungs, and phthisis if the tubercle bacillus is present.

In a hospital ward, especially in one containing suppurating wounds or infectious cases, the number of germs in the air may be very large; and they can only be removed by ventilation.

The presence of human beings warms and moistens the air to an unpleasant extent when ventilation is imperfect. Perspiration, carious teeth, suppuration and gangrene all contribute to the unpleasant odours met with in a badly ventilated space.

Fresh air contains ·04 per cent. of CO_2 or 4 parts in 10,000, and in a well ventilated room the amount of CO_2 should never exceed 6 parts per 10,000. To maintain this standard each individual requires 3,000 cubic feet of fresh air per hour.

Ventilation is maintained chiefly by the action of the winds, and by the property possessed by gases of rising when warm.

As the foul and warm air is found in the upper part of a room, outlets are provided near the ceiling. These

consist of the upper part of the windows and special outlets built into the walls.

Fresh air enters through the lower part of the windows, the doors and through special inlets built about 5 feet up the walls.

In wards provided with an open stove a large amount of air is drawn up the chimney when the fire is burning, and its place is taken by fresh air from outside.

To test the freshness of air in a ward, go into the open air for several minutes and on returning any foulness can be at once detected.

Avoid draughts. On a windy day the windows on the leeward side of the ward should alone be opened.

This question of ventilation requires the nurse's constant attention, as it is of the utmost importance in treating disease and preventing the spread of infection.

(*c*) TEMPERATURE.

Wards may be heated by open stoves, radiators, hot water or steam pipes. When an open stove is used the chimney acts as a ventilator, but the ward is apt to get dirty more quickly from smoke and particles of soot. In some cases the stove is in the centre of the ward and the inlet for fresh air and the outlet for the smoke run under the floor and up the walls outside the building. Every ward should possess a thermometer, and the nurse must endeavour to keep the temperature as near 60° F. as possible. The ward must be warmed by building up the fire and not by closing the windows. The coldest time is from 2 a.m. to sunrise, and the temperature of the ward will then require special attention.

The ventilation and warming of a ward are very closely connected.

(*d*) EQUIPMENT.

The nurse must know exactly what furniture and appliances are supplied to the ward, and see that they are in place and in serviceable condition. This can only be done by cultivating tidiness. Every article should be kept in its proper place, so that it can be found readily when wanted.

If anything is missing or broken or otherwise unserviceable the fact must be reported *at once.*

See that there is a sufficient supply of all consumable stores. These will include dressings, pins, paper, pens and ink, requisition and other forms, methylated spirit, &c.

The various fittings must also be frequently examined and any defect reported. As examples, broken windows and window catches, defective electric lights, an escape of gas, broken locks, leaking flush tanks, stopped-up drains may be mentioned.

Cracked or broken glass and crockery must be fully reported on the proper form.

BEDS AND BED MAKING.

Hospital bedsteads are made of iron with a fixed wire spring mattress. Older forms consist of a plain iron framework to which a stout piece of canvas is lashed, the object being that the canvas could be removed and washed.

A bed for an ordinary case is made up as follows :—

A hair mattress is placed on the wire one and covered with a blanket, which must be tightly tucked in all round. Over this is placed the under sheet which is also tucked in all round. The upper sheet is tucked in at the foot only, leaving sufficient at the head of the bed to turn down over the quilt. One, two, or more blankets are similarly arranged, and, with the upper sheet, are then tucked in at the sides. Over all is placed the quilt, which should not be folded over at the upper end but at the foot of the bed. The upper sheet is turned down over the quilt. Two or more pillows are well shaken and arranged at the head.

A draw-sheet consists of a sheet folded lengthways and laid across the under sheet, so that the patient's buttocks will lie in the centre. The fold should be upwards and the free edges downwards, the ends being tucked in at the sides. It is used to prevent soiling of the under sheet, as it is much more easily changed. In

cases of incontinence of urine and fæces a mackintosh may be placed under the draw-sheet.

To change the draw-sheet, the ends are released, the patient raised, and the sheet drawn more to one side. If soiled by excreta, it must be completely removed and another arranged.

A water-bed consists of an indiarubber bag, the size of the bed, which is filled with warm water. It is placed either on fracture boards or on another mattress, and then filled about two-thirds full.

Water- and air-cushions, which are smaller than a water-bed, are also used for the same purpose, namely, the prevention of bed-sores.

A bed cradle is used to keep the bed-clothes off the patient's legs or trunk, and consists of iron hoops fixed to a wooden frame. The iron should be covered with a roller bandage.

A knee pillow is sometimes used to prevent the patient slipping down in the bed, or to relax the abdominal muscles. An ordinary pillow is placed in a sheet folded lengthwise, and arranged under the patient's knees. The ends of the sheet are twisted and tied to the sides or the head of the bed.

BED MAKING FOR HELPLESS PATIENTS.

To change the under sheet:—

Having removed all the upper clothes except one blanket, roll the patient gently on to one side and roll up the dirty sheet lengthways against his back. Likewise roll up the clean sheet for half its width and place the rolled part also against his back, spreading out the remainder over the near side of the bed. Now roll the patient on to the opposite side, remove the soiled sheet from under him, and unroll the clean one. In cases where the patient cannot be rolled on one side, as in fractures of the bones of the leg, it is better to roll up the soiled sheet from the foot and introduce the clean one in the same way, passing both upwards under the body. The patient may be able to raise himself by the chain attached to the head of the bed.

To change the upper sheet:—

Remove all the upper clothes except one blanket, and over this place the clean sheet. Now draw out the blanket, place it over the clean sheet, and replace the other bed-clothes.

WASHING AND DRESSING THE SICK.

Patients not confined to bed should have a hot bath at least twice a week. Those confined to bed must have a "blanket bath" night and morning.

Blanket Bath:—

(*a*) Prepare the sponge, soap, warm water, two dry towels, methylated spirit, dusting powder, and two blankets (which should be kept for the purpose).

(*b*) Close the windows and place screens round the bed.

(*c*) Remove all the upper bed-clothes and the patient's shirt. Place one of the special blankets over and the other under the patient.

(*d*) Place one towel under the head, and wash the face and ears, afterwards drying them carefully with the other towel.

(*e*) Turn down the blanket to the waist and wash the neck and chest.

(*f*) Replace the blanket, and wash each arm in turn, returning them under the blanket when dried.

(*g*) Raise, but do not remove, the blanket and wash the abdomen and groins. Be careful not to wet the blanket and to thoroughly dry the groins.

(*h*) Uncover each leg in turn, wash, dry, and re-cover with the blanket.

(*i*) Roll the patient on to his side and wash the back and buttocks.

(*j*) Rub the back and buttocks with methylated spirit and dust with the powder. Cut and clean the finger and toe nails.

(*k*) Remove the two special blankets, put on the shirt, and replace the bed-clothes.

Always sponge in one direction; rubbing up and down irritates the patient.

Turpentine is useful to remove ingrained dirt on the hands and feet.

When washing a newly-admitted patient look for scabies, pediculosis, and rashes.

CARE OF THE SKIN.

Patients who are confined to bed for a long time, and especially cases of paralysis, are very liable to the formation of bed-sores (p. 110). They occur over the sacrum, heels, and shoulders, and are due to pressure combined with a wet and dirty condition of the skin.

Prevention of Bed-sores:—

1. **A well-made bed.**
   There must be no creases in the under blanket or sheet; no bread crumbs, nor rucking up of the night shirt. A water-bed, water-cushion, or air-cushion may help; while grummets (rings of cotton wool or tow surrounded by a spiral bandage) may be made for the heels and head.
2. **Cleanliness and dryness.**
   Patients with incontinence of urine and fæces are especially liable to bed-sores. As soon as the draw-sheet is soiled it must be changed, and the patient's skin washed and dried.
3. **Change of position.**
   If the nature of the case permits, do not let the patient always lie in the same position, but roll him occasionally on to the opposite side.
4. **Hardening the skin.**
   After each blanket bath the back is rubbed with methylated spirit, and dusting powder applied.
   Dusting powder consists of equal parts of zinc oxide and starch.
   It is useless to apply these unless the patient's skin is kept clean and dry.

CARE OF THE HAIR.

The hair of a helpless patient must be combed and brushed after each bath. Look out for pediculi. Never allow the hair to grow long.

CARE OF THE NAILS.

Both the finger and the toe nails must be cut and cleaned, the nails should be cut square and not rounded off at the sides. A bone or ivory cleaner is better than a knife for removing dirt from under the nails.

CARE OF THE MOUTH.

In acute diseases, dried saliva and particles of food collect in the mouth, around the teeth and between the lips. This collection is called *sordes*, and renders the mouth foul and uncomfortable. It must be removed twice daily, or oftener.

Prepare dressing forceps, small pieces of lint, a receiver, and a small gallipot to hold the mouth wash. The usual washes are:—Glycerine and borax, glycerine and lemon juice, peroxide of hydrogen, lysterine, and weak carbolic lotion (1–80).

Lanoline may also be used in the case of a badly cracked tongue.

Wrap a piece of lint round the forceps, dip it in the wash, and clean all round the teeth. Then clean the roof of the mouth, the cheeks, the gums, and the tongue, using a clean piece of lint each time. The dirty pieces are put into the receiver, and afterwards burnt. Instead of the lint and forceps, cotton wool may be wrapped round the end of a piece of wood, the size of a penholder, which is burnt after use.

DRESSING THE SICK.

When taking off the clothes in the case of an injury to the arm, remove them from the *sound* side first. When putting on the shirt, &c., put the *injured* limb into the sleeve first.

The same rule applies to trousers and pyjamas.

OBSERVATION OF THE PATIENT.

The nurse must observe certain points about his patient, and be able to report the details to the Medical Officer.

Remember that the Medical Officer wants facts, not opinions: "The patient slept for only three hours last night"; not, "I don't think he had a very good night."

1. Temperature of the body.

This is taken with a clinical thermometer, by placing it in the mouth, the axilla, or the rectum. When taken

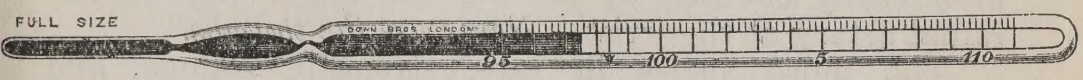


Fig. 128.
Clinical Thermometer.

in the mouth, the thermometer is placed under the tongue, and the patient told to close his lips, but not his teeth. When taken in the axilla, the axilla must be well dried first, the thermometer inserted, and the arm brought across the chest. It is left in position for from $\frac{1}{2}$ to 5 minutes, according to the make of instrument.

The scale is marked in degrees, from 95° to 110° F., and each degree is again divided into five parts, so that each division represents one-fifth, or ·2 of a degree.

The normal temperature (98·4°) is marked by an arrow.

The thermometer is kept in a small glass vessel, containing carbolic lotion (1–40), and rests on a pad of cotton wool. It is dried on a piece of lint before use, and the mercury shaken down to 95°.

Temperatures are taken every four hours in acute cases, morning and evening in all others. In the former, 10 a.m., 2 p.m., 6 p.m., 10 p.m., 2 a.m., and 6 a.m. are suitable hours; and in the latter, just before the Medical Officer's visits, say at 8.30 a.m. and 5.30 p.m.

Record the temperature on the chart at once.

The temperature is *raised* in fevers, and in inflammation of any part of the body; and is *lowered* in shock, collapse, and hæmorrhage.

Shivering is a sign that the temperature is rising. A shivering fit is called a **Rigor.**

When a patient has a rigor, apply a hot-water bottle to his feet, put an extra blanket over him, and, if there is no contraindication, give him hot milk to drink.

Flushing of the face usually accompanies a high temperature.

Sweating is usually a sign that the temperature is falling.

2. **Pulse.**

The normal pulse rate is about 72 per minute. It is most easily counted by placing the finger tips on the radial artery at the wrist. *Never use the thumbs.*

The pulse varies in rate, strength, volume, and regularity.

3. **Respiration.**

The normal rate is about 17 per minute, and is counted by watching or feeling the movements of the chest. It is most important that the patient should be unaware that his respirations are being counted, as he can easily alter the rate.

The breathing may be deep and noisy (stertorous), shallow and feeble, or sighing in character.

4. **Posture.**

Much may be learnt from the position the patient takes in bed :—

(*a*) **Lying flat on the back,** is common towards the end of a long and severe illness, and when there is great weakness. Any tendency towards a more upright position is, therefore, a good sign, indicating returning strength.

(*b*) **Sitting up in bed** is the position in dyspnœa, such as occurs in heart disease.

(*c*) **Lying on one side** is observed in cases of pleurisy and pneumonia, the patient lying on the bad side to give free play to his sound lung.

(*d*) **Lying on the back with the knees drawn up** is a sign of inflammation in the abdomen, such as peritonitis and appendicitis. The knees are drawn up to relax the tension of the abdominal muscles, and so to ease the pain.

(*e*) **Lying on the face** eases the pain of colic and dyspepsia.

5. **The Skin.**

Observe whether it is hot or cold, dry or moist, and the colour. It may be pale or flushed, blue in cyanosis, yellow in jaundice. Examine the skin for rashes, and note the amount of fat. **Emaciation** is the term for wasting.

6. **The Tongue.**

It may be pale or deep red (scarlet-fever), moist or dry and cracked, clean or covered with white or brown fur, small or large. In some cases of paralysis it is protruded to one side, and in drunkards is tremulous.

Scars, the result of its having been bitten, are often seen in epileptics.

7. **Sleep.**

It is important to note how long a patient sleeps, and whether peaceful or restless.

8. **Pain.**

Note the situation, the intensity, and the character of the pain. It may be tearing (as in cancer), darting (neuralgia), stabbing (pleurisy), or aching (rheumatism).

Note whether it is affected by respiration, food, light, sound, or movement.

9. **Appetite.**

Note the amount of food taken, the frequency of the feeds, the relish with which they are taken, and whether hunger is relieved. The taking of food may be followed by pain, vomiting, hiccough or eructation.

10. **Thirst.**

This is increased in fevers, shock, and hæmorrhage.

11. **Coughing.**

Note the frequency, severity, and duration. A fit of coughing may be brought on by change of position, or by exposure of part of the body to the air. The cough may be hard and dry or loose and soft, husky, or accompanied by a whoop.

With regard to the expectoration, or *sputum*, note the quantity, the ease or difficulty with which it is brought up, and its character. Sputum may be watery or thick, frothy or sticky, and the colour may be white,

grey, black, yellow, red or brown. Mucous sputum is whitish and watery, but becomes yellow and lumpy when pus is present. The presence of soot or coal-dust in the air results in grey or black sputum. It may be streaked with, or mixed with, blood; or the blood may have been altered in the lung and then resembles brown rust. This *rusty sputum* is well marked in cases of pneumonia.

Save a specimen of sputum if it is at all abnormal.

12. Vomiting.

Note the frequency, whether it occurs before or after food, whether accompanied by *nausea* (feeling of sickness) or pain, and the nature of the vomit. When it occurs after food and is accompanied by pain, the cause is usually in the stomach; but when it occurs independently of food and is not accompanied by nausea the cause is usually injury or disease of the brain or kidneys.

The vomit may consist of food, bile or fæcal matter, and may contain blood. Blood which has been in the stomach for some time is dark brown in colour and resembles coffee grounds.

Vomiting is often caused by medicines, which may or may not have been given for that purpose, and by irritating the fauces while cleaning the mouth.

Always save a specimen of the vomit.

13. The Stools.

Always examine the stools in an acute case and after the administration of an enema. They may be solid, semi-solid or liquid. In some liquid stools small masses of hard fæces are found; these are called *scybala*. The amount should be noted. The colour varies considerably and is of some importance. Thus:—

In cholera the stools are very pale and watery—rice water stools.

In enteric fever the stools are yellow and watery—pea soup stools.

In jaundice the stools are very pale and solid—like putty.

Bright blood may be present, or the stool may be black—like tar—when the blood has been passed on from the stomach; this is called *melæna*. Black stools,

not due to blood, may be passed by patients who are taking iron or bismuth. Green stools are sometimes seen in cases of diarrhœa, the colour being due to certain germs.

The odour also varies, and is particularly offensive in cases of enteric fever and jaundice.

Gall stones and intestinal worms may also be met with, and should be washed and put in a specimen glass for examination.

14. The Urine.

A specimen must be collected from every fresh case and sent in a proper urine glass for examination.

This subject is fully discussed under **Disease of the Kidney.**

15. The Effect of Remedies.

It is part of a nurse's duty to observe and report the effect of the remedies ordered by the Medical Officer. Thus, he must observe whether the calomel caused a movement of the bowels, whether the chloral produced sleep, whether the morphia eased the pain, &c.

Many drugs when given over a long period accumulate in the system and produce poisoning, and the nurse should be able to recognise the earlier symptoms of such an occurrence. He must then report to the Medical Officer before giving another dose.

Drug.	Early Symptoms of Poisoning.
Opium and morphia	Drowsiness, contracted pupils.
Strychnine	Twitching of the muscles.
Arsenic	Pain in the stomach, vomiting, diarrhœa.
Belladonna and Atropine	Dryness of the mouth, dilated pupils.
Quinine	Headache, buzzing in the ears.
Salicylates	Deafness, buzzing in the ears.
Mercury	Soreness of the gums, salivation.
Potassium iodide	Running at the eyes and nose, papular rash.

CLINICAL CHARTS.

On these are noted the temperature, pulse, respirations, stools, urine, &c. They are ruled to record the temperature morning and evening, so that one chart will last three weeks. When the temperature is taken four-hourly, lines should be ruled in red ink marking off six divisions to a day, and the chart will then last only one week. The patient's name, rating, and ship are entered in their proper places, and the month and days are written on the top.

The temperature is recorded by a dot *on* the line, and the dots are connected by strokes. When two adjoining temperatures are the same, the dots are connected by a short curved line. *Make the dots large and the lines fine, and always in ink.* Tidiness and neatness in keeping a chart are always appreciated by Medical Officers.

The rate of the pulse and respirations are marked in figures. The quantity of urine is not recorded except in special cases, but the number of times the bowels are open each day must always be entered. When the bowels are not open, make a small dot and don't leave the space entirely blank.

The occurrence of vomiting, rigors and hæmorrhage, the administration of an enema, the passing of a catheter with the amount of urine drawn off, saline effusions and hypodermic injections, and the first dressing after an operation should all be indicated in writing on the chart, under the hour at which they took place. When neatly done, these records are of considerable help to the Medical Officer.

WRITING REPORTS.

Written reports are made by both the day and the night nurse in acute cases. The report should contain a brief account of *all* that has happened during the watch, such as the amount of sleep, details of fresh or important symptoms, the amount and kind of food taken, whether urine, fæces or flatus have been passed, all new instructions from the Medical Officer, the state of dressings, and the temperature of the ward. When relieved by another nurse always turn over your orders to him personally as well as in the report, stating especially the time when the next feed, dose of medicine, dressing, &c. is due.

M.41 (late M 40.a)

October M.—No.—41—H.S.&S.A. November 4th 5th 6th

CLINICAL SHEET

Patients Name: Henry Wood

Age: 21

Rating: Stoker

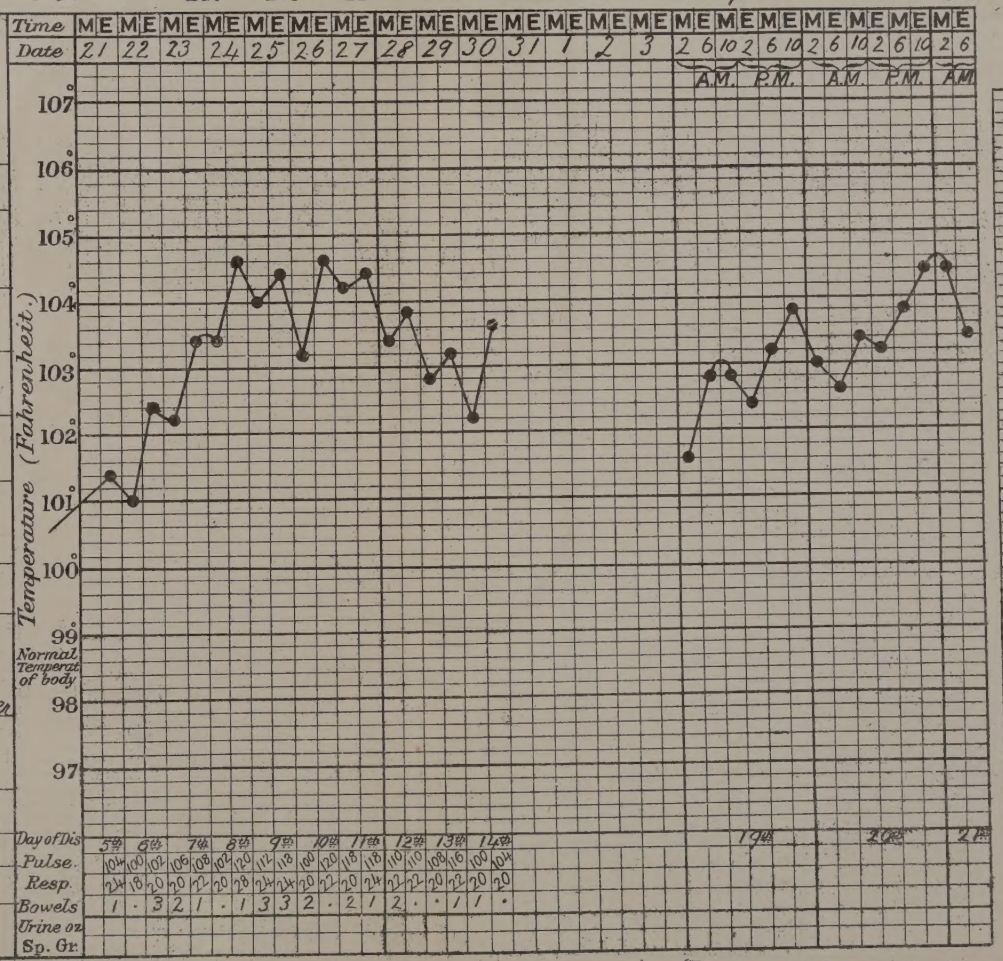
Ships Name: "Blenheim"

Date of Admission: 21 Oct. 1911

Result and Date:

Disease: Enteric Fever

Remarks:



3933. Malby & Sons, Lith.

Fig 129.

FEEDING THE SICK.

In hospital there are three scales of diet: full, low, and milk. Patients on full and low diets have their meals as follows:—

Breakfast - - - - -	7.30 a.m.
Dinner - - - - -	12 noon.
Tea - - - - - -	4 p.m.
Supper - - - - -	7 p.m.

Patients on milk diet are fed every two hours. This diet consists of 3 pints of milk, so that each feed will measure 5 ounces. This quantity must be accurately measured, and diluted with 3 ounces of water, barley water, or soda water. The feeds are given at night as well as by day, but the patient must not be awakened for feeds or medicine.

Milk is given in a feeding cup, which must be held by one hand to the patient's lips while his head is raised with the other arm. The patient should take each feed as prepared, and in no case must it be allowed to stand on the bedside table until the patient feels inclined to take it. He must be fed.

Wash the feeder immediately after use.

In certain cases the patient is fed by the stomach tube, the nasal tube, or by the rectum.

(*a*) By the Stomach Tube.

The stomach tube is a long stout rubber tube about $\frac{1}{4}$-inch in diameter, and resembles a large soft catheter. There is generally a black mark 18 inches from the eye end, and a funnel is attached to the other end. To use it, lubricate with glycerine or milk, pass the end to the back of the mouth and tell the patient (who should be sitting up) to swallow. It must not be forced down the throat, and, should much coughing occur, must be at once withdrawn. When the black mark is on a level with the teeth, raise the funnel and pour in the food.

The food consists chiefly of milk; but eggs, beef-tea, or any fluid food may also be given. The quantity is from 1 to $1\frac{1}{2}$ pints given three or four times a day, and it must always be given warm. When all has been

taken, pinch the tube with the finger and thumb and withdraw it gently but not too slowly.

Run water through the tube to clean it.

In some cases a mouth gag is necessary to prevent the patient biting the tube.

(*b*) By the Nasal Tube.

The apparatus consists of a glass funnel connected to a piece of rubber tubing, which is attached to a No. 8 soft catheter by a small piece of glass tubing.

The catheter is lubricated with butter, and, with the patient sitting upright, passed directly *backwards* into one nostril. *It must on no account be passed upwards.* The patient is told to swallow when he feels the tube at the back of his nose, and it is passed gently on until only about 2 inches of the catheter project from the nostril. The food is then poured into the funnel as in the previous method.

(*c*) By the Rectum.

Food is passed into the rectum by a catheter and funnel. In any case it must be given slowly or it will not be retained. The food is given warm; it consists of only those articles of diet which can be absorbed by the intestinal mucous membrane; and, as it will not come in contact with gastric or pancreatic juice, it must all be peptonised.

The foods mostly used are milk, beef-tea, yolk of egg and brandy.

The official Naval Hospital preparation is :—

Yolk of one egg.	
Strong beef-tea - - -	1 oz.
Milk - - - - -	1 oz.
Brandy - - - - -	4 drachms.
Liquor pancreaticus - - -	1 drachm.

The egg is beaten up with the milk, the beef-tea and brandy added, and the whole heated to 140° F. The liquor pancreaticus is then added, and the mixture allowed to stand in a warm place for one hour. The enema is given at a temperature of 100° F.

The usual quantity is from 2 to 5 ounces, and should never exceed 8 ounces. This is given every four or six hours.

As nutrient enemata irritate the bowel, it must be washed out with warm water once in every 24 hours.

GIVING MEDICINE.

When giving medicine by the mouth :—

1. Read the directions on the label of the bottle and follow them exactly.
2. Shake the bottle. This does no harm even when not mentioned in the directions.
3. Measure the dose accurately into a glass or Procter's measure, holding the bottle with the label upwards, otherwise drops may run over it and obliterate the directions.
4. Clean the measure immediately after use.
5. Keep medicines for internal use apart from external applications, such as lotions and liniments.
6. When ordered to be taken three times a day, medicine should be given at 10 a.m., 2 p.m., and 6 p.m., unless ordered otherwise, so as not to interfere with meals.

   When ordered to be taken four-hourly, the same hours will do, but the administration is continued through the night, at 10 p.m., 2 a.m., and 6 a.m.

A list of the abbreviations most commonly used in prescribing is given in the chapter on **Dispensing.**

When medicine is particularly nauseating a little sugar, lemon juice, soda water, or bread may be given to remove the taste.

To give Castor Oil.

Rinse out a wine-glass with brandy, peppermint water, or lemon juice, leaving a little in the glass. Pour in the oil, cover it with a little brandy or whatever is being used, and tell the patient to swallow it whole—like an oyster.

Pills are intended to be swallowed whole. Some patients can swallow them easily, others require a drink of water.

Powders are given dry. They should be placed well at the back of the tongue and washed down with a drink of water.

Tablets may be chewed or crushed and given as a powder. The latter method is the better.

Cachets of wafer paper are used to enclose nauseous drugs. They are swallowed whole with water.

Medicines are also given by the rectum and by injections under the skin.

A Suppository is a small cone-shaped mass of Oil of Theobroma with which is mixed the active drug. It is dipped in Olive Oil and passed well up into the rectum, the patient lying on his left side with the knees drawn up. Morphia is often given in this way.

HYPODERMIC INJECTIONS.

Powerful drugs which are small in bulk are often injected under the skin with a hypodermic syringe. They are dissolved in water, and the greatest care must be taken in giving the exact dose, which is usually only a few minims.

The hypodermic syringe is made of metal, and the scale of minims is marked on the piston, which has a screw thread on which runs a milled nut. The needle is detachable and made of steel.

Before use, the barrel is boiled but not the needle, as it tends to blunt the point. The needle is put into Carbolic Lotion.

After fitting the needle, boiled water is drawn into and forced out of the syringe a few times to remove the carbolic. A little of the drug is then poured into a small clean measure, and the syringe slowly filled with it, taking care to admit no air. Hold the syringe with the needle upwards and press the piston until a drop of liquid appears. This will show that all air has been expelled, and the syringe is again completely filled. The nut is then screwed down to the figure representing the number of minims to be given.

Hypodermic injections are usually given in the forearm, avoiding any superficial vein. The skin is cleaned with ether, and, while pinched up by the finger and thumb, the needle is introduced horizontally and the piston pressed home. Withdraw the needle and keep the finger over the puncture for a few seconds. No dressing is necessary.

To clean the Syringe.

Boil the barrel and then run methylated spirit through both barrel and needle and leave in the air to dry. Put a clean wire into the needle from the point and return the instrument to its case.

The drugs given in this way are Apomorphine, Atropine, Digitaline, Ergotine, Eserine, Hyoscine, Perchloride of Mercury, Morphia, Nitroglycerine, Pilocarpine, Renalin, Strychnine, and the local anæsthetics like Cocaine.

THROAT SWABBING.

The throat is sometimes swabbed with antiseptics or astringents. Wrap a piece of cotton wool round the end of a pair of forceps, dip it in the lotion, and, while depressing the tongue with a spatula, swab the affected part—usually the tonsils—while the patient says "Ah."

GARGLES.

These consist of solutions which the patient holds in his mouth with the head thrown back, while he says "Ah." He should not swallow any of the gargle, but spit it out after use. This is repeated five or six times. Gargles are usually given three times a day.

MOUTH WASHES are used to rinse the mouth. The patient should be told to force the liquid backwards and forwards between the teeth by the tongue and cheeks, and then to spit it out.

SPRAYS are fluids applied to the throat. There are many forms of apparatus.

INSUFFLATIONS are powders blown into the part, such as the throat, ear, or nose. There are many forms of insufflators.

ENEMATA.

An Enema is an injection into the rectum, and may be purgative, medicinal, or nutrient.

1. **Purgative Enemata** are given to produce a movement of the bowels.
2. **Medicinal Enemata** contain some drug which it is impossible or inadvisable to give by the mouth, as in cases of unconsciousness.
3. **Nutrient Enemata** provide a means of feeding the patient and have already been described.

Position of the Patient.

The patient is turned on his left side, with the knees drawn up and the buttocks near the edge of the bed. When the patient cannot be turned on his side, he must lie on his back with the legs separated. A mackintosh is placed under the buttocks to prevent wetting of the bed.

Apparatus.

A bowl to hold the enema, a bed pan, a mackintosh, screens, vaseline and the syringe or tube and funnel.

(*a*) **Higginson's Syringe** consists of a rubber tube with a bulb in the centre. To one end is attached a

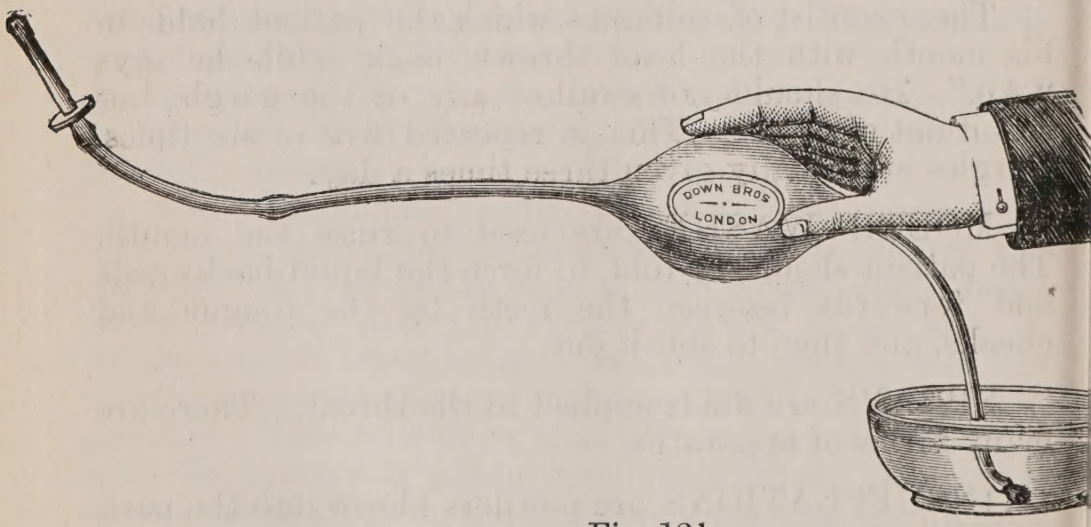


Fig. 131.
Higginson's Enema Syringe.

bone, vulcanite or glass nozzle, in the other end is a ball valve. To use, place the valve end in the liquid to be injected and alternately squeeze and relax the bulb until no air or bubbles come from the nozzle. Rub a little vaseline on the nozzle, introduce it into the rectum and again alternately squeeze and relax the bulb until the necessary amount has been injected.

(*b*) **A Glycerine Syringe** is made of vulcanite, and the nozzle is long and curved. It holds 2 drams.

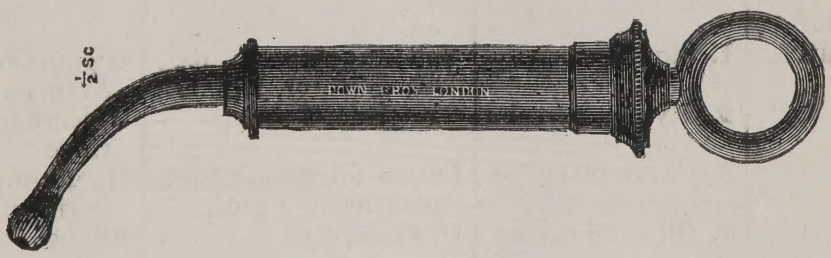


Fig. 132.
Glycerine Syringe.

(*c*) **The Funnel and Catheter** is used for thick enemata. A No. 10 soft rubber catheter is attached to a funnel.

(*d*) **A Ball Syringe** consists of a somewhat pear-shaped or round india-rubber bulb, to the narrow end of which is fixed a nozzle. It holds about 8 ounces.

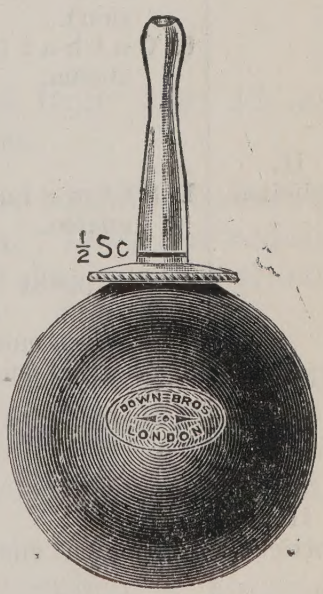


Fig. 133.
Ball Enema Syringe.

After administering an enema, tell the patient not to strain, but to try and retain it as long as possible.

Purgative enemata usually act in 5 or 10 minutes, but, should no movement of the bowels occur, the fact must be reported.

Enemata.

Action.	Name.	Constituents.	How Administered.
I. Purgative.	1. Simple enema -	Yellow soap, 1 oz.; warm water, 1 pint.	Higginson's Syringe.
	2. Glycerine enema	Glycerine, 2 drams -	Glycerine syringe.
	3. Castor oil enema	Castor oil, 2 oz.; Simple enema, 1 pint.	Higginson's Syringe.
	4. Olive oil enema	Olive oil, 6 oz. - -	Funnel and catheter.
	5. (*a*) Turpentine enema (as a purgative).	Turpentine, ½ oz.; mucilage of starch, 15 oz.	Funnel and catheter.
	5. (*b*) Turpentine enema (to relieve distension).	Turpentine, ½ oz.; mucilage of starch, 2 oz.	Funnel and catheter.
	6. Cathartic enema.	Magnesium sulphate, 1 oz.; olive oil, 1 oz.; mucilage of starch, 15 oz.	Funnel and catheter.
II. Medicinal.	1. Stimulant enema.	Brandy, 1 oz.; black coffee, 5 oz.	Funnel and catheter or ball syringe.
	2. Astringent or starch and opium enema.	Tincture of opium, 30 minims; mucilage of starch, 2 oz.	Funnel and catheter.
	3. Sedative enema	Chloral hydrate, 30 grains; potassium bromide, 30 grains; water, 2 oz.	Funnel and catheter or ball syringe.
III. Nutrient.	1. Nutrient enema	1 egg; strong beef tea, 1 oz.; milk, 1 oz.; brandy, 4 drams; liquor pancreaticus, 1 dram.	Funnel and catheter or ball syringe.

CATHETERS.

These are hollow tubes which are passed through the urethra into the bladder to draw off urine. Six varieties may be met with.

1. **Silver Catheters** are curved metal instruments

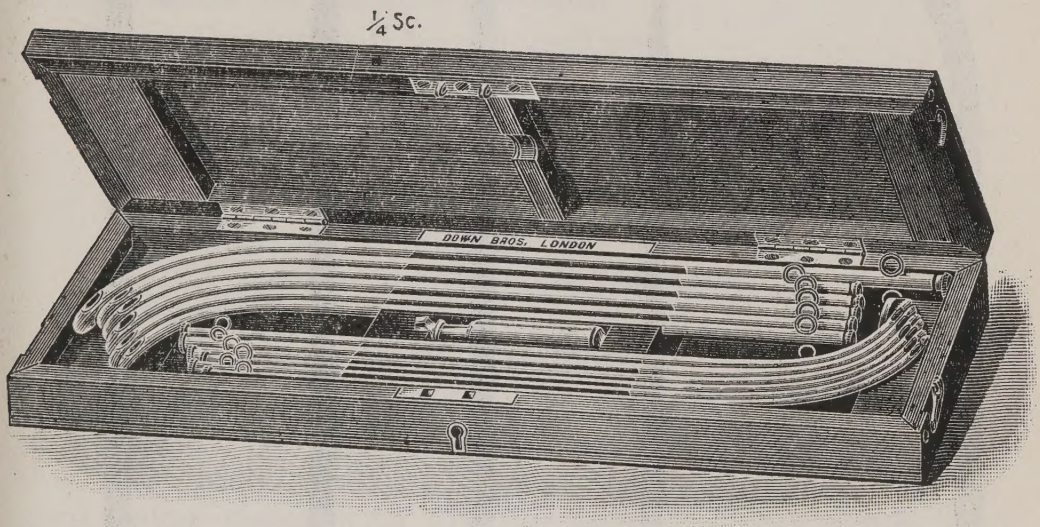


Fig. 134.
Silver Catheters.

graduated in thirteen sizes from ½ to 12, and supplied in a mahogany case.

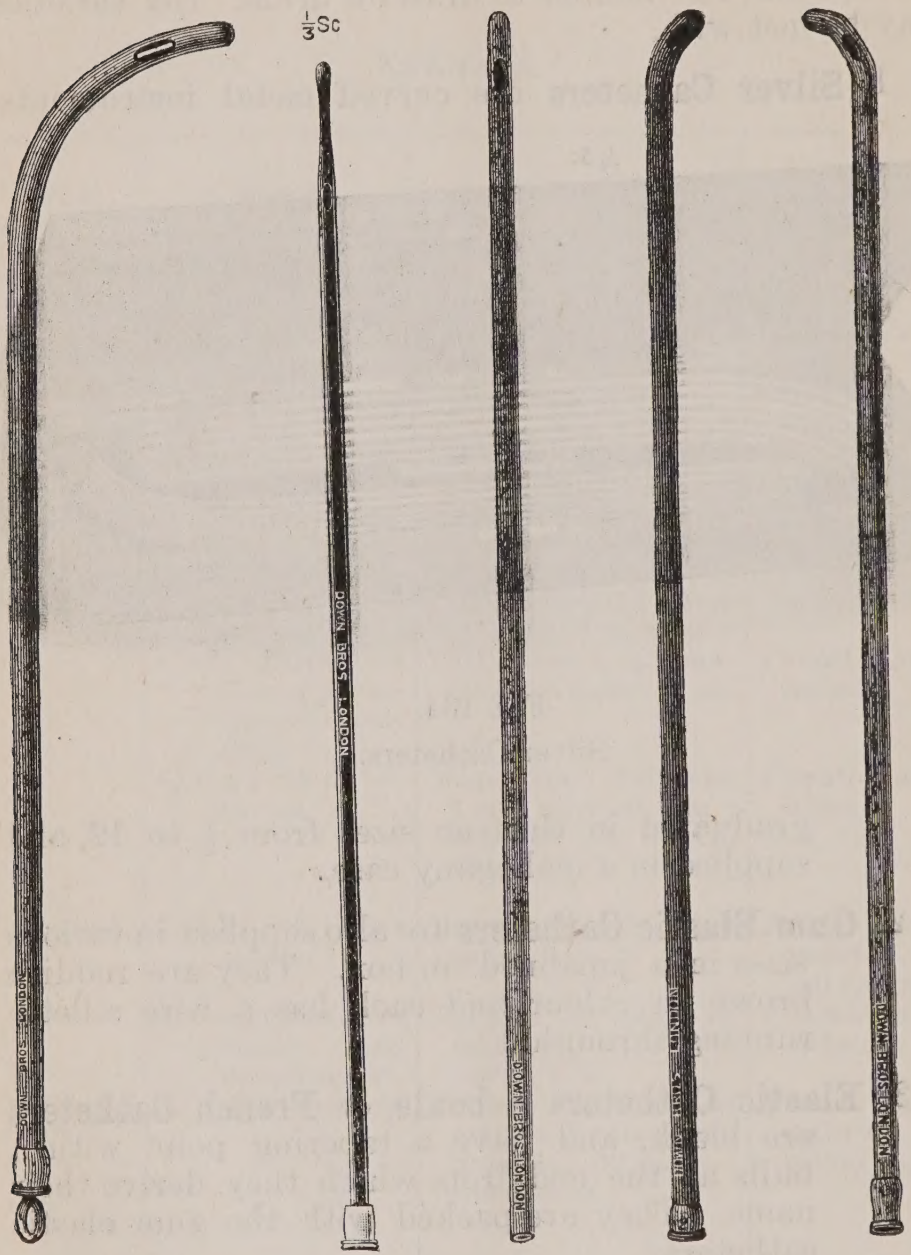
2. **Gum Elastic Catheters** are also supplied in various sizes in a japanned tin box. They are reddish brown in colour, and each has a wire stilette running through it.

3. **Elastic Catheters à boule,** or **French Catheters** are black, and have a tapering point with a bulb at the end from which they derive their name. They are packed with the gum elastic catheters.

4. **Soft Rubber Catheters** are supplied to hospitals but not to ships.

5. **Coudé Catheters** have a single angular bend near the eye.

6. **Bi-coudé Catheters** have a double angular bend near the eye.



1. 2. 3. 4. 5.

Fig. 135.

Catheters.

1. Gum Elastic. 2. French. 3. Soft Rubber.
4. Coudé. 5. Bi-coudé.

Sterilisation of Catheters.

Silver and soft rubber catheters are sterilised by boiling, but the others must only be soaked in carbolic lotion (1–40). Before use they are put into warm boric lotion.

Preparation for Catheterisation.

The following will be required :—

(*a*) The catheters chosen by the Medical Officer.
(*b*) An instrument tray containing warm boric lotion.
(*c*) Glycerine.
(*d*) One or two urinals.
(*e*) A receiver for the soiled catheters.
(*f*) Swabs.
(*g*) Lotio Hydrarg. Perchlor.

Fold the bed-clothes down to just above the patient's knees, and cover them with a sterilised towel. Draw up his shirt, place a blanket over his chest and abdomen, and cover these with another towel. Draw back the foreskin, and thoroughly clean the end of the penis with a swab and the perchloride lotion. Cover the end of the penis with a clean swab until the Medical Officer is ready. When silver catheters are used, place all the apparatus on a table at the *left hand side* of the bed. When other catheters are used, place them at the *right hand side.*

Always measure and chart the amount of urine drawn off.

FOMENTATIONS.

These are employed in the application of moist heat to a part of the body, and may be simple or medicated.

A simple fomentation consists of a piece of white lint or flannel wrung out of boiling water. A piece of lint, large enough when folded to cover the part, is laid on a clean towel spread over a basin. Boiling water is then poured over the lint, the towel folded over it, and wrung as tightly as possible. The towel is unfolded, and the damp lint removed, folded, and placed on the part. It is covered with jaconet, over which is placed a

thick layer of cotton wool, and the whole is fixed with a bandage. The jaconet and wool must overlap the lint by at least one inch, so that the heat and moisture are retained.

A medicated fomentation consists of a piece of white lint wrung out of some solution, such as boric, carbolic, or perchloride lotions, or a solution of soda.

A boric fomentation is an antiseptic dressing. It is made in the same way as a simple fomentation, except that boric lint is used instead of white lint or flannel.

Turpentine stupes are used as counter irritants. A simple fomentation is prepared, but a little turpentine is sprinkled on the lint *before* adding the boiling water.

Opium stupes are used to ease pain. They are prepared as a simple fomentation, but 1 dram of laudanum is sprinkled on the lint.

Fomentations are changed at least every four hours. The bandage, wool, and jaconet are removed from the old dressing before the new one is prepared, and may be used again.

POULTICES.

These form another means of applying heat. They are made with linseed meal or bread.

Linseed-Meal Poultice.

Procure a basin, spatula, piece of linen, white gauze, the meal, and boiling water. Warm the basin and spatula with the water, pour away, and fill the basin with 4 or 5 ounces of fresh boiling water. Stir in sufficient meal until the whole is like thick porridge and does not stick to the sides of the basin. Spread this evenly on the linen, about half an inch thick, leaving a margin of one inch all round. Over the meal place a single layer of gauze and turn the edges of the linen over it. Apply to the part, cover with cotton wool, and fix with a bandage. The object of the gauze is to prevent the meal sticking to the skin. Another method is to rub a little olive oil on the patient's skin before applying the poultice, in which case the gauze is omitted.

Beware of scalding the patient.

Bread Poultice.

This is made with stale bread crumb and boiling water, and is completely folded in gauze. It is not so satisfactory as the linseed meal poultice.

Mustard Poultice.

This is made by mixing mustard with the dry linseed-meal and then proceeding as for an ordinary linseed poultice. The amount varies from equal parts of each to 1 of mustard and 16 of meal.

COUNTER-IRRITANTS.

These are substances which produce reddening of the skin. They are employed to relieve pain and to check inflammation.

The chief are **Tinctura Iodi Mitis** and **Tinctura Iodi Fortis** which are painted on the skin.

Mustard Poultices and **Turpentine Stupes** have the same effect.

BLISTERING AGENTS.

A Mustard Leaf is dipped in warm water and applied. It should be covered with a little cotton wool, held loosely in place with strapping.

Liquor Epispasticus or **blistering fluid** is made from cantharides. Paint a ring of olive oil on the skin which has been previously washed and shaved, and inside this paint the fluid with a brush. Cover with cotton wool and strapping.

The Medical Officer will give orders how long the blistering agent is to be left; at the end of this time (not more than six hours) remove the dressing. With a pair of sterilised scissors snip the lowest part of the blister and squeeze out the serum on to a swab, taking care not to remove the epidermis. Dress with sterilised white gauze or boric ointment.

If the blister has not risen at the end of 6 hours, exposing the part to the air for an hour often has the desired effect.

LINIMENTS.

These are rubbed into the skin by the hand to relieve pain. Each rubbing should occupy at least 5 minutes. The chief liniments in use are :—

Linimentum Saponis, or Soap Liniment.
Linimentum Terebinthinæ, or Turpentine Liniment.
Linimentum A. B. C., or Aconite, Belladonna and Chloroform Liniment.

LOTIONS.

These are applied to the skin on lint, covered with jaconet, wool, and a bandage. The chief lotions are :—

All the Antiseptic Lotions.
Lotio Plumbi.
Lotio Plumbi cum Opio.
Lotio Rubra.
Lotio Alkalina.
Lotio Calamina.
Lotio Calcis Sulphurata.

The last named is not applied on lint but directly to the skin, and is used in the treatment of Scabies.

Evaporating Lotions.

These contain spirit which, by evaporation, produces cold. A double fold of lint is wrung out of the lotion, applied to the part and left *uncovered*. In cases where it is apt to slip a few turns of bandage may be used.

Glycerine and Belladonna.

This is painted on to the part to relieve pain, and should be covered with lint and a bandage.

LEECHES.

The animals are about 2 inches in length, with a body tapering at each end, and are used to withdraw blood from a part thereby relieving congestion and pain. Each leech will extract about 1 dram of blood.

Method of Application.

The skin must be washed and all trace of soap removed. Place the leech tail first into a test tube, and hold the mouth of the tube against the skin until the

leech bites. You can tell the head only by watching the direction in which the animal moves. Several leeches may be applied. If they do not bite readily rub a little sugar and milk on the skin.

The leech will drop off when full of blood, but if it is advisable to remove it sooner, put a pinch of salt on it when it will at once relax its hold on the skin. It must never be pulled off. Apply an aseptic dressing to the punctures after washing them with boric lotion. The leech is then killed by placing it in carbolic lotion.

ICE BAGS.

An ice bag is a flat circular india-rubber bag with a metal screw stopper. It is filled with broken ice, and suspended over the part so that it only just touches the skin, from which it is separated by a single layer of lint. It must be removed and refilled before all the ice has melted. Ice bags are frequently used in cases of injury or disease of the brain, and in internal hæmorrhage.

HOT-WATER BOTTLES.

These are made of copper or india-rubber, the latter being the better form. After filling with hot water, the bottle must be enclosed in a flannel bag or placed under the blanket. The greatest care must be taken to avoid burning the patient, especially in cases of insensibility and paralysis.

DRY CUPPING.

This is another method of counter-irritation, and aims at drawing the blood from the deeper parts to the surface. In **wet cupping** blood is actually withdrawn by scratching the skin before applying the cup, but this method is now seldom used.

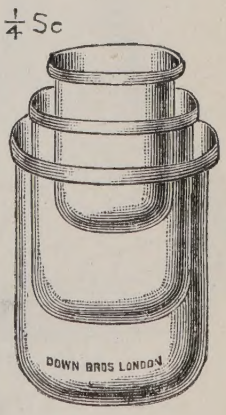


Fig. 136.
Cupping Glasses.

Procedure.

Take a cupping glass or thick tumbler and smear the rim with vaseline. Into it drop a piece of blotting paper soaked in methylated spirit, and light this. Before the flame has gone out invert the glass over the

part. The air in the glass is exhausted by the flame and a vacuum is formed. The skin rises up into the glass to fill this space in the form of a red tumour.

To remove the glass, press on the skin near the rim until a little air is admitted, when the glass comes away easily.

Klapp's Suction Bells (sometimes called Bier's Cups) are now largely used in place of the older cupping glasses. They are made in various shapes and sizes, and consist of a glass bell from which the air is exhausted, after application to the part, by means of a rubber suction pump.

These bells are also used to withdraw pus from boils, carbuncles and abscesses.

A BRONCHITIS KETTLE consists of a spirit lamp

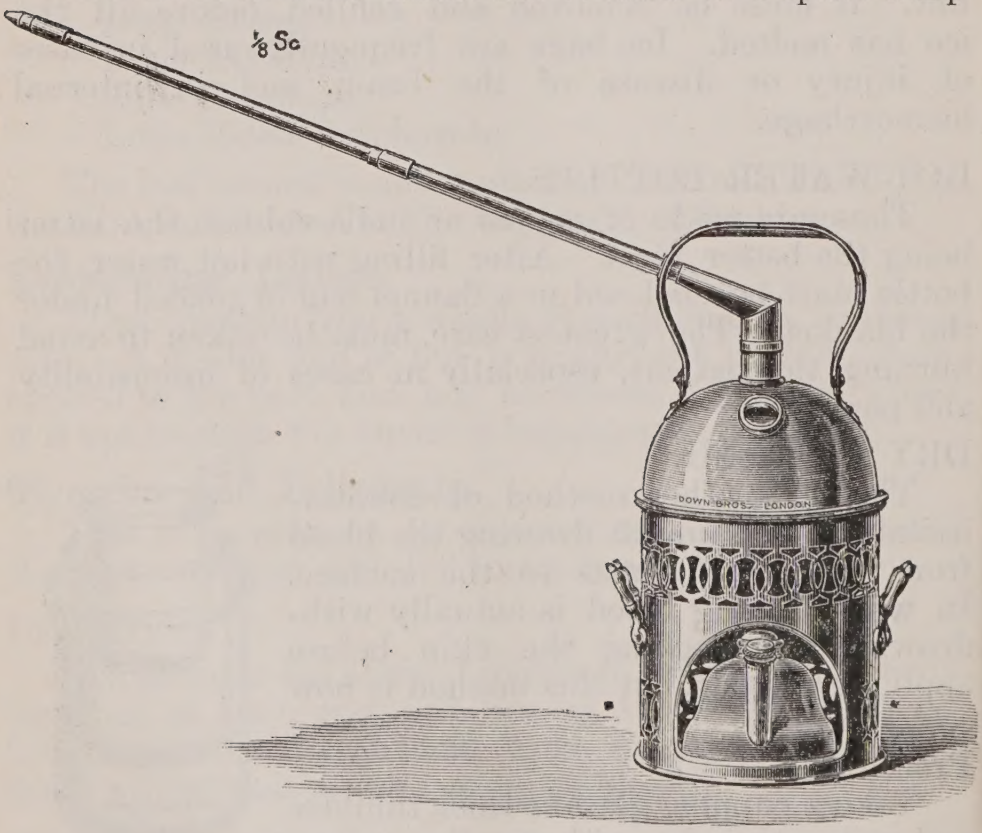


Fig. 137.—Bronchitis Kettle.

over which is placed a kettle with a long straight spout. It is used for producing steam.

VAPOUR BATH.

The patient's body is subjected to an atmosphere of steam, whereby perspiration and the excretion of waste matter are stimulated.

Remove the patient's shirt and place him on a blanket under which a long mackintosh sheet has been arranged. Over him arrange a large bed cradle covered with, first a blanket, then a mackintosh, and lastly another blanket. See that these are tucked in all round. Introduce the spout of a bronchitis kettle under these coverings at the foot. To prevent scalding by the condensed steam dripping from the spout of the kettle, cover the patient's feet and legs with a small blanket.

When the desired effect has been produced the kettle and coverings are removed, the body washed and dried, and a clean shirt put on.

STEAM TENT.

This is used in cases where it is desired that the patient should breathe warm moist air, as in cases of acute bronchitis. Arrange screens round the head, the foot, and one side of the bed, and make a roof by pinning a sheet over the top.

The bronchitis kettle stands on a chair at the side of the bed, and the spout is directed into the tent but not directly on to the patient.

NELSON'S INHALER.

This consists of an earthenware bottle having a glass mouthpiece running through the cork, which fits into the neck of the bottle.

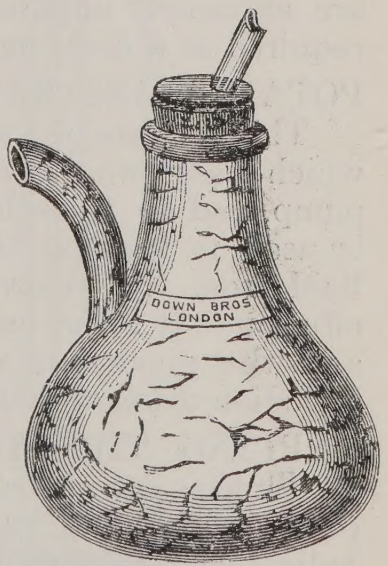


Fig. 138.
Nelson's Inhaler.

The inhaler is half filled with water at a temperature of 150° F., and to this the prescribed drug (such as tr. benzoin. co., eucalyptus, &c.) is added, the usual strength being 1 dram of the drug to a pint of water. The inhaler is wrapped in a towel, and the patient breathes the vapour through his mouth.

INHALATION OF OXYGEN.

Oxygen is used in diseases of the lungs accompanied by cyanosis, such as pneumonia. It is supplied compressed in large metal cylinders, to which is attached a piece of rubber tubing and a glass funnel.

The cylinder should be placed upright against the head of the bed and lashed to it. The valve is then opened by unscrewing with the key until a gentle stream of gas can be felt issuing from the funnel. The funnel is held a few inches from the patient's face, and each administration should last about ten minutes, repeated as necessary. It is advisable to warm the oxygen by passing it through a flask containing warm water.

EXPLORING SYRINGE.

This is exactly like a large hypodermic syringe, and is prepared for use in the same way. It is used to discover the nature of the contents of the pleural cavity or of a tumour. The needle is introduced into the part, the piston pulled out, and the contents of the syringe are then expelled into a clean gallipot, where they can be observed. Sterilisation of the skin and the syringe are extremely important. Gauze and collodion will be required as a dressing for the puncture.

POTAIN'S ASPIRATOR.

This consists of a glass bottle, through the stopper of which pass two tubes. To one is attached an exhaust pump, and to the other a special trocar and canula. It is used in tapping the chest, that is, drawing off the fluid from the pleural cavity in a case of pleurisy with effusion. It is not used in cases of empyema. The skin and the apparatus must be sterilised. A gauze and collodion dressing will be required.

TAPPING THE ABDOMEN.

Fluid is drawn from the peritoneal cavity by means of a trocar and canula. The canula is a straight, hollow metal tube, into which fits the sharp-pointed trocar. Thus fitted, they are forced through the abdominal wall, and the trocar withdrawn; the fluid will then escape through the canula, and is caught in a receiver. After removing the canula, a gauze and collodion dressing is applied to the wound.

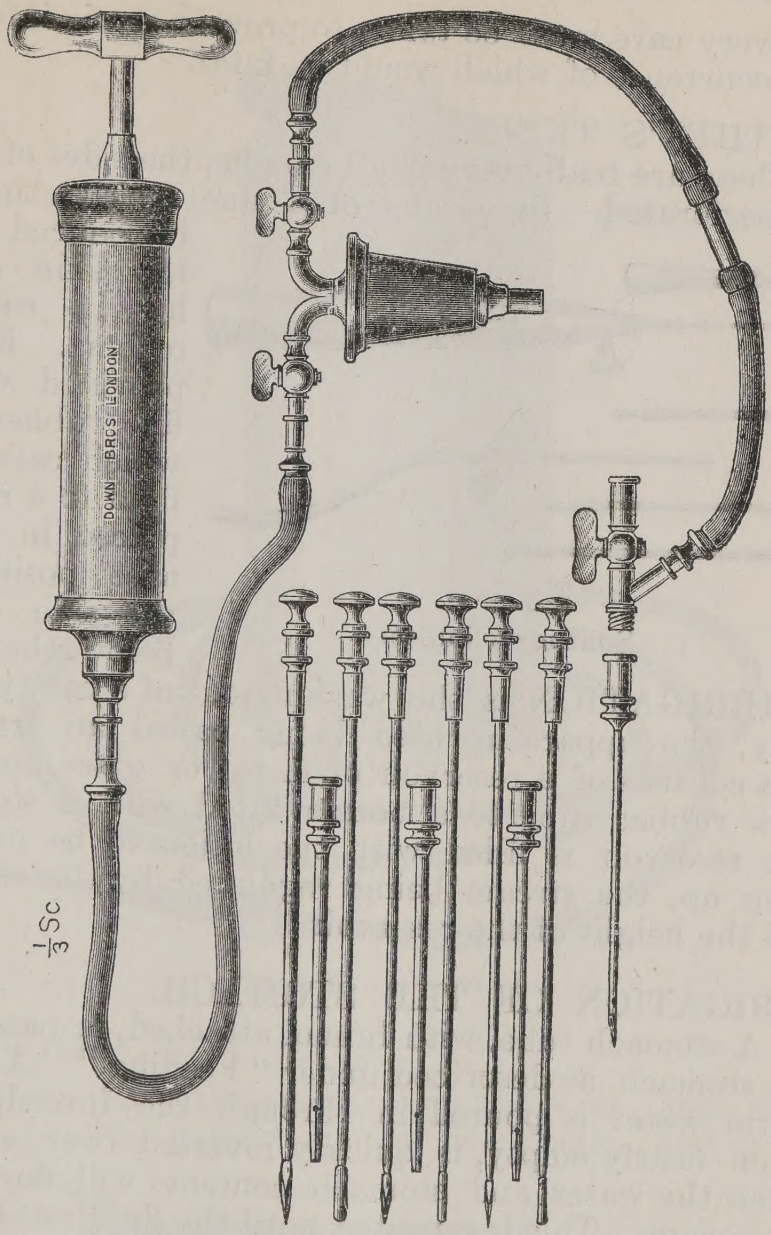


Fig. 139.—Potain's Aspirator.

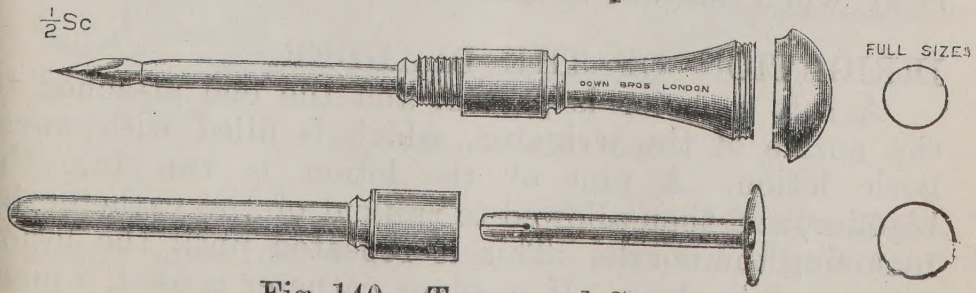


Fig. 140.—Trocar and Canula.

Every care must be taken to prevent septic infection, the occurrence of which would be fatal.

SOUTHEY'S TUBES.

These are really very small canulæ, the sides of which are perforated. By means of a fine trocar, they are introduced under the skin of the leg in cases of œdema. Each is provided with a fine rubber tube, which carries the fluid to a receiver placed in a suitable position at the side of, but below, the bed.

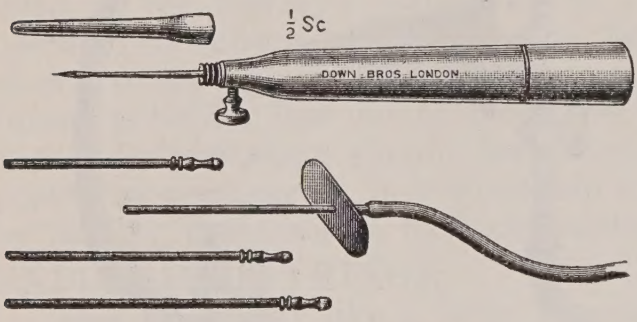


Fig. 141.
Southey's Tubes.

IRRIGATION is the washing out of a cavity of the body, the apparatus used being called an **irrigator.** This consists of a reservoir of metal or glass, connected by a rubber tube to a nozzle fitted with a stop-cock. The reservoir is filled with the lotion to be used and hung up, the stream being regulated by the stop-cock and the height of the reservoir.

IRRIGATION OF THE STOMACH.

A stomach tube, with funnel attached, is passed into the stomach, as described under "Feeding." A pint of warm water is poured in through the funnel, which, when nearly empty, is quickly inverted over a bucket, when the water and stomach contents will flow out by syphonage. This is repeated until the fluid returns quite clear, when the tube is withdrawn.

IRRIGATION OF THE BLADDER.

A soft catheter is passed, and the end attached to the nozzle of the irrigator, which is filled with warm boric lotion. A pint of the lotion is run into the bladder, and then allowed to run out of the catheter by removing the nozzle. This is repeated until the lotion returns quite clear. If a silver catheter is used, a piece

of rubber tubing is necessary to make the connection with the nozzle.

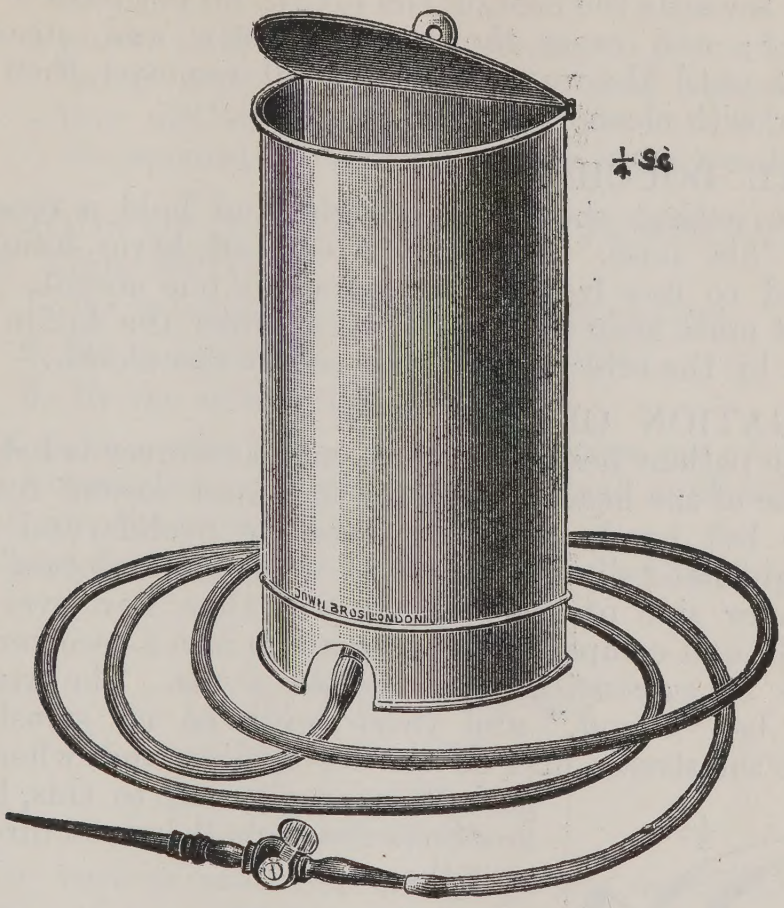


Fig. 142.—Irrigator.

SYRINGING THE EARS.

A brass ear syringe and warm water, or boric lotion, are used. The patient should sit upright, and hold a

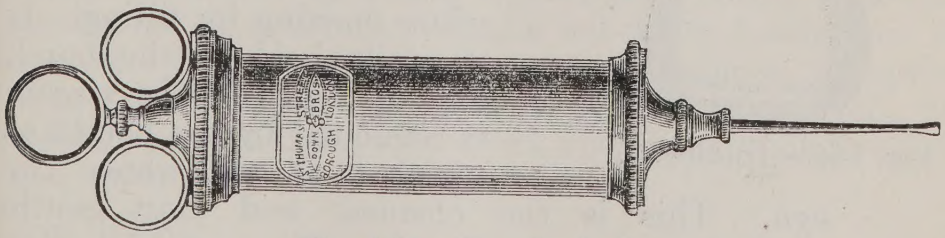


Fig. 143.—Ear Syringe.

kidney bowl under the ear. Fill the syringe, turn it nozzle upwards, and force out any air. Holding the

syringe in one hand, draw the ear gently backwards with the other to straighten the canal. Direct the nozzle towards the roof of the canal; do not push it into the ear; and press the piston gently and steadily. Repeat until the wax, or pus, is all removed, then dry the ear with clean wool or white gauze.

NASAL DOUCHE.

The patient should sit upright, and hold a receiver under his nose. A gentle stream of boric lotion is allowed to flow from an irrigator into one nostril. The patient must keep his mouth open, when the lotion will return by the other nostril, and not by the mouth.

IRRIGATION OF THE EYE.

The patient lies on his back, and a receiver is held at the side of the head. With the first and second fingers of the left hand, gently separate the eyelids, and with the right hand direct the flow of warm boric lotion into the inner side of the eye. It will then flow over the eyeball, and escape at the outer angle into a receiver.

To be successful, you must be gentle. The stream must be "round," and there must be no splashing. Direct the stream first on to the eyelids, and, when the patient is accustomed to this, let it flow on to the eyeball, but not directly over the pupil.

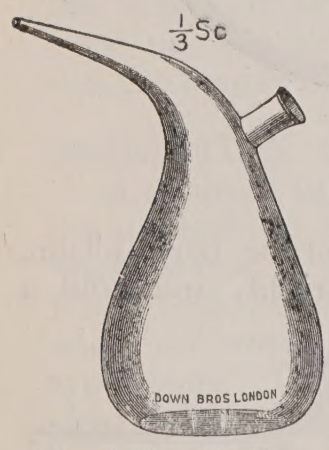


Fig. 144.—Undine.

There are three methods of supplying the stream :—

1. **By an Undine.**—This is a small glass flask made with a finely-drawn nozzle, and a wider opening for filling. It is easily held in the hand, and the force of the stream is regulated by the height at which it is held above the eye. This is the cleanest and most gentle method.

2 **By an Irrigator.** — The irrigator is suspended about six inches above the patient's head, and is fitted with a fine nozzle.

3. **By a Swab.**—A swab is dipped into a bowl of lotion, and gently squeezed over the eye. The lowest part of the swab should be drawn into a point, so that only one stream is formed. The hands must be thoroughly washed before using this method, and it should only be used when the apparatus mentioned above is not available.

METHODS OF REDUCING THE TEMPERATURE OF THE BODY.

1. By reducing the number of bed-clothes.
2. By the external application of cold.
3. By the action of drugs.

Of these methods, the first may always be used; the last is unsatisfactory; while the external application of cold forms the most efficient treatment.

There are many ways in which this may be done :—

(*a*) Cold bath.
(*b*) Cold sponging.
(*c*) Tepid sponging.
(*d*) Cold pack.
(*e*) Ice pack.
(*f*) Ice cradle.

The various baths and spongings are described elsewhere.

COLD PACK.

The patient is wrapped in a sheet wrung out in cold water, and covered with a blanket, the under bed-clothes being protected by a long mackintosh sheet. The feet should not be covered, so that a hot-water bottle can be applied if the patient shivers or becomes collapsed. When the temperature has been sufficiently reduced, the sheet is removed, the skin dried, and the patient wrapped in a warm blanket.

ICE PACK.

This is applied in a similar manner, but the sheet is wrung out of ice-cold water, and pieces of ice are wrapped in the folds.

ICE CRADLE.

This consists of a large bed cradle, suspended from which is a metal tray, on which ice is placed. The bed-clothes are replaced over the cradle so that the patient lies in an ice-cold atmosphere.

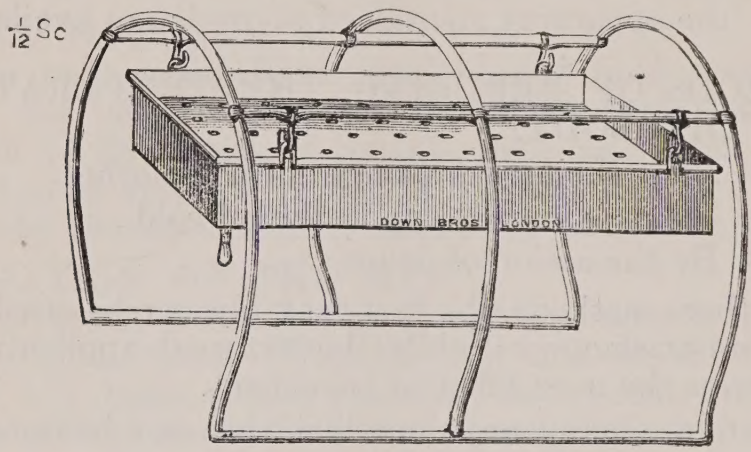


Fig. 145.

Ice Cradle.

BATHS IN COMMON USE.

Name.	Temp.	Constituents.	Use.
1. Cold Bath -	65°	Water - - -	To reduce the temperature.
2. Tepid Bath -	90°	Water - - -	,, ,, ,,
3. Warm Bath -	95°	Water - - -	Cleansing.
4. Hot Bath -	100°	Water - - -	Cleansing and diaphoretic.
5. Alkaline Bath -	95°	Sodium Carbonate, 6 oz.; Water, 30 gallons.	In Rheumatism and Skin Diseases.
6. Bran Bath -	95°	Bran, 4 lbs.; Hot Water, 1 gallon, added to warm bath.	In Skin Diseases.
7. Sulphur Bath -	100°	Sulphuretted Potash, ¼ oz. to each gallon of water.	,, ,, ,,
8. Mustard Bath -	100°	Mustard, 1 oz.; Water, 5 gallons.	Diaphoretic and stimulant.
9. Vapour Bath -	—	Steam - - -	Diaphoretic.

BANDAGING.

BANDAGES may be classed into three large groups :—

1. Triangular bandages.
2. Roller bandages.
3. Special bandages.

1. THE TRIANGULAR BANDAGE.

This bandage is made by taking a piece of calico, about 40 inches square, and cutting it diagonally into halves. Of the three borders of the bandage the longer is called the *base*, and the others the *sides*. Of the three corners the upper one, opposite the base, is the *point*, the two others the *ends*.

The bandage may be used either unfolded or folded as a broad, narrow, or medium bandage.

The broad bandage is made by spreading the bandage out, bringing the point down to the base, and then folding in two. **The narrow bandage** is made by folding the broad bandage again in two. **The medium bandage** is made by bringing the point down to the base, and then folding into three. This bandage may be used instead of the broad or narrow bandage when it is better suited to the proportions of the patient. It is sometimes advisable to halve the size of the bandage by bringing the two ends together before folding it into the broad, narrow, or medium bandage.

When not in use it should be folded as a narrow bandage, the two ends should be turned to the centre, and the bandage then folded into four, reducing it to a packet about $6\frac{1}{2}$ by $3\frac{1}{2}$ inches.

The bandage should be fastened either by a pin or by tying the ends with a reef knot. Compare the granny knot, which should be carefully avoided.

For securing splints the bandages must be applied firmly, but not so tightly as to constrict the circulation of blood in the limb. When the patient is in a recumbent position double the bandage over a splint to pass it under the trunk or lower limb.

As a general rule :—**For the Trunk** a broad bandage should be used. Pass it once round the trunk and fasten it by tying the ends, or with two or three safety pins, on the side opposite the fracture, but if to secure a splint for a broken thigh, over the splint.

For the Arm or Forearm.—The narrow bandage should be used. Pass it twice round the limb and tie the ends over the outer splint.

For the Thigh or Leg.—The narrow or medium bandage may be used. It is frequently convenient to double the bandage at the centre, pass it under the limb, bring the loop over the limb, pass both ends of the bandage through it in opposite directions, and tie them over the outer splint.

In applying bandages near a fracture the upper one should be secured first.

For the Scalp.—Fold a hem about $1\frac{1}{2}$ inches deep along the base, place the bandage on the head so that the hem lies on the forehead, close down to the eyebrows, and the point hangs down at the back; carry the two ends round the head above (not over) the ears, and tie low down on the forehead; draw the point first downwards and then turn it up and pin it to the bandage on the top of the head.

For the Forehead, Side of the Head, Eye, Cheek and any other part of the body that is round (as the arm or thigh). The narrow bandage should be used, its centre being placed over the dressing, and the ends

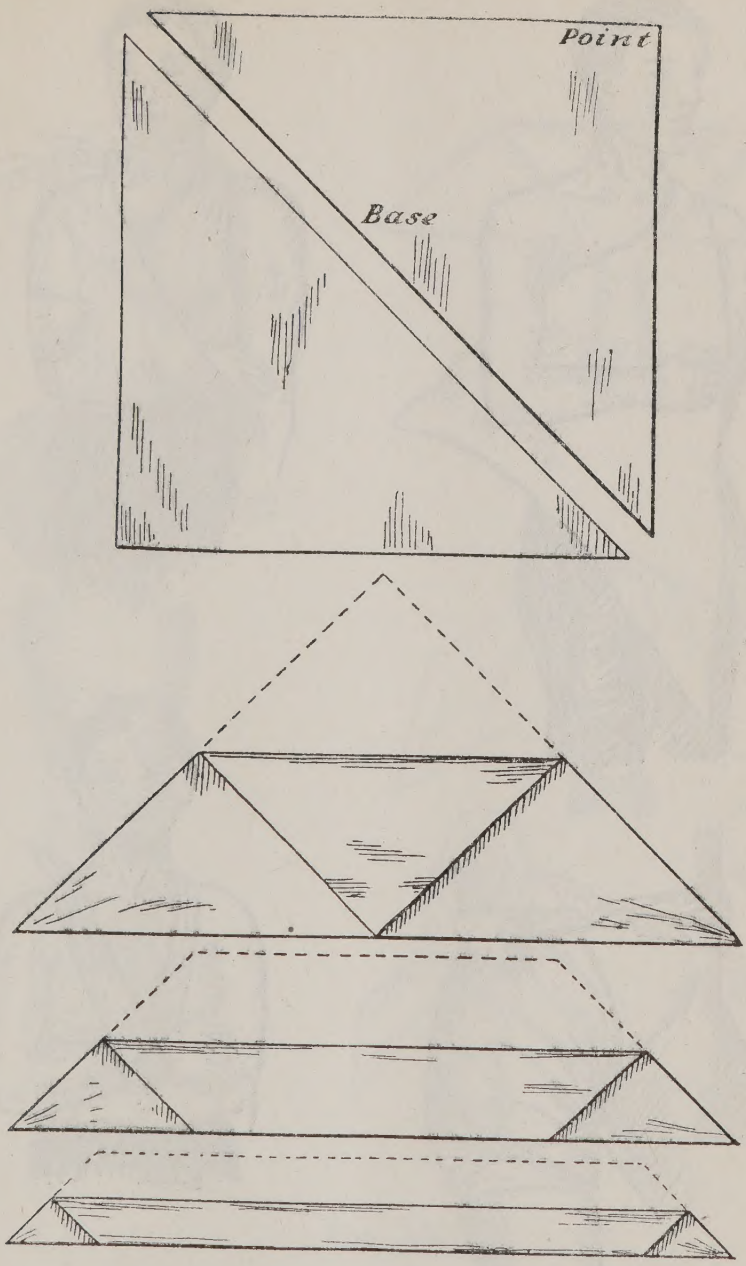


Fig. 146(*a*).

Triangular Bandage.

(First Aid in the Royal Navy.)

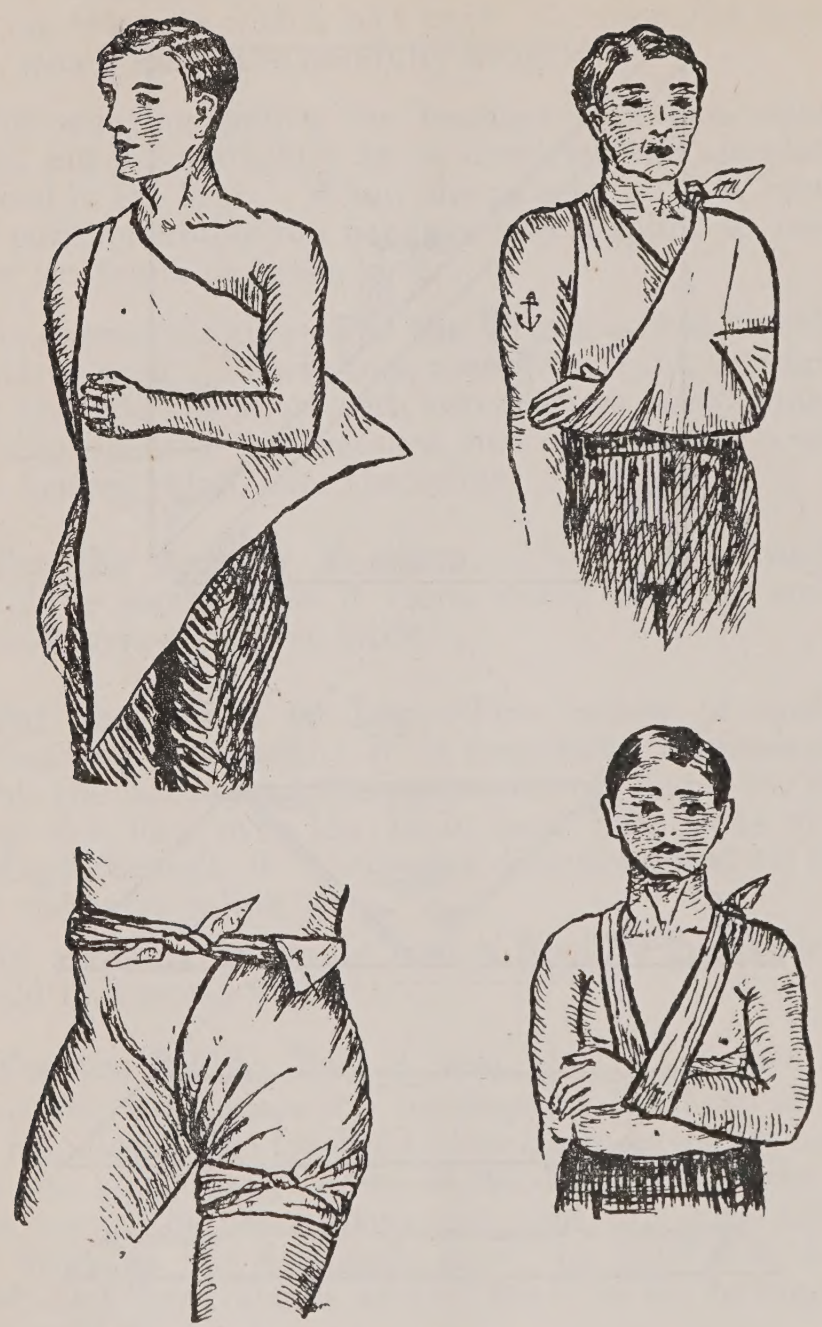


Fig. 146(*b*).

Uses of the Triangular Bandage.

(First Aid in the Royal Navy.)

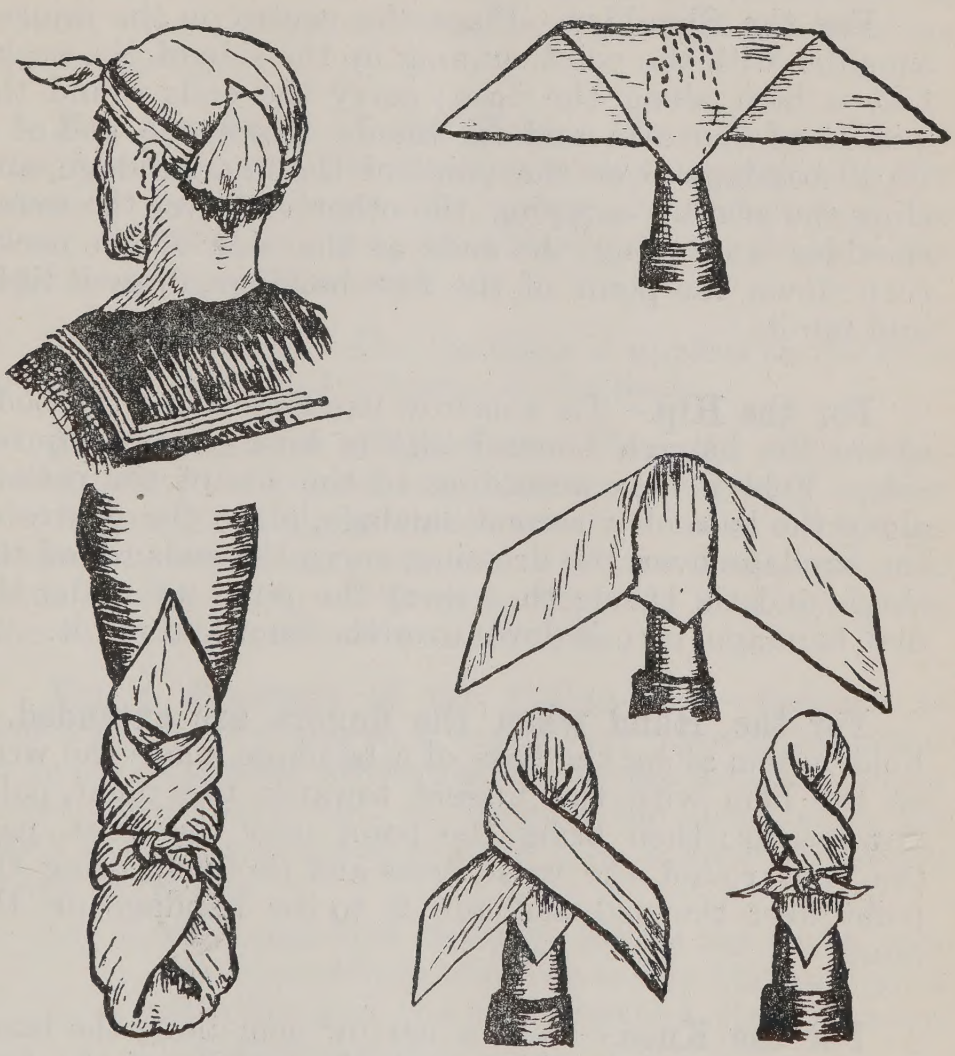


Fig. 146(*c*).

Uses of the Triangular Bandage.

(First Aid in the Royal Navy.)

being carried round the head or limb (as the case may be) and tied over the dressing.

For the Shoulder.—Place the centre on the injured shoulder with the point running up the side of the neck; fold a hem along the base; carry the ends round the middle of the arm and tie them. Place one end of a broad bandage over the point of the first bandage, and sling the arm by carrying the other end over the sound shoulder and tying the ends at the side of the neck; turn down the point of the first bandage, draw it tight and pin it.

For the Hip.—Tie a narrow bandage round the body above the haunch bones with the knot on the injured side. Fold a hem according to the size of the patient along the base of a second bandage, place the centre of the bandage over the dressing, carry the ends round the thigh, and tie them; then carry the point up under the first bandage, turn it down over the knot and pin it.

For the Hand when the fingers are extended.—Fold a hem along the base of a bandage, place the wrist on the hem with the fingers towards the point, palm downwards; then bring the point over the wrist, pass the ends round the wrist, cross and tie them, bring the point over the end and pin it to the bandage on the hand.

For the Knee.—Fold a narrow hem along the base; lay the point on the thigh and the middle of the base just below the knee-cap, cross the ends just behind the knee, then over the thigh and tie them, bring the point down and fasten to the base.

For the Elbow.—Fold a narrow hem along the base and lay the point on the back of the arm and the middle of the base on the back of the forearm, cross the ends, first in front of the elbow, then over the arm, and tie them at the back or front. Bring down point and pin.

For the Foot.—Place the foot on the centre of a bandage with the toes towards the point, draw up the point over the instep, bring the two ends forward and cross them; now pass the ends round the instep and tie them; draw the point forward and pin it to the bandage on the instep.

For the Front of the Chest.—Place the middle of the bandage over the dressing with the point over the shoulder on the same side; carry the ends round the waist and tie them; then draw the point over the shoulder and tie to one of the ends.

For the Back.—The bandage is applied as the foregoing, except that it is begun at the back.

For a Fracture of the Jaw.—Place the palm of the hand below the injured bone, and press it gently against the upper jaw; apply the centre of a narrow bandage under the chin, carry one end over the head, cross the ends at the angle of the jaw, carry the long end across the chin and tie the ends on the side.

For a Fracture of the Collar-bone.—Remove as much of the clothing as is expedient; place a pad about 2 inches thick and 4 inches across in the armpit; gently bend the forearm well up, keeping the shoulder as far back as practicable, and support it in a St. John's sling, made as follows:—

(*a*) Lay an unfolded bandage across the chest, over the injured limb, with one end on the uninjured shoulder and the point beyond the elbow on the injured side.

(*b*) Pass the lower end of the bandage under the injured limb, across the back and tie the ends loosely in the hollow in front of the sound shoulder.

(*c*) Fold the point over the elbow of the injured limb and secure it by one or two pins.

Tightly secure the injured limb to the side by a broad bandage passed round the elbow and trunk; now tighten the sling.

2. ROLLER BANDAGES are made from various materials.

1. **Calico,** unbleached—supplied in sheets and torn up in different widths as required.

2. **Cotton,** woven—supplied ready rolled in various widths.

They may be—

(*a*) Plain white.

(*b*) Blue—treated with sal alembroth.

(*c*) Mauve—treated with cyanide of mercury.

3. **Gauze.**

4. **Domette**—a sort of flannelette.

5. **Flannel.**

6. **Muslin** — used with plaster-of-Paris.

7. **Elastic Webbing.**

8. **Plain Elastic**—called **Martin's Bandage.**

Roller bandages may be applied in three ways :—

1. The simple spiral.
2. The reversed spiral.
3. The figure of eight.

The simple spiral is applied by winding the bandage spirally round the limb, each turn overlapping two-thirds of the previous one. It can only be applied to parts which are of uniform thickness, such as the fingers, the wrist, and the ankle.

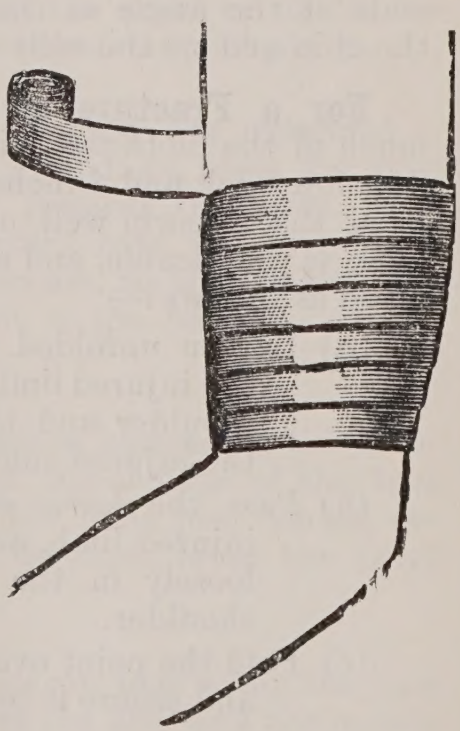


Fig. 147.
Simple Spiral Bandage.
(R.A.M.C. Training.)

The reversed spiral.—After fixing the bandage by two or three turns, place the disengaged thumb on the lower border of the bandage at the outer side of the limb and reverse the bandage held in the other hand, that is, turn it over so that what was the upper border is now the lower. Continue the turn round the limb and again reverse at the same point, so that the crossings are kept in line. Each turn should overlap exactly two-thirds of the previous one. This is applied to parts which are gradually increasing in diameter, such as the leg, thigh, and forearm.

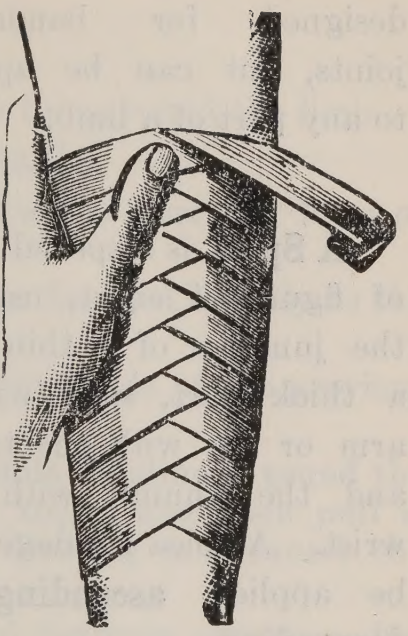


Fig. 148.
Reversed Spiral Bandage.
(R.A.M.C. Training.)

The figure of eight.—The bandage is carried up the limb from within outwards, round the back, down from

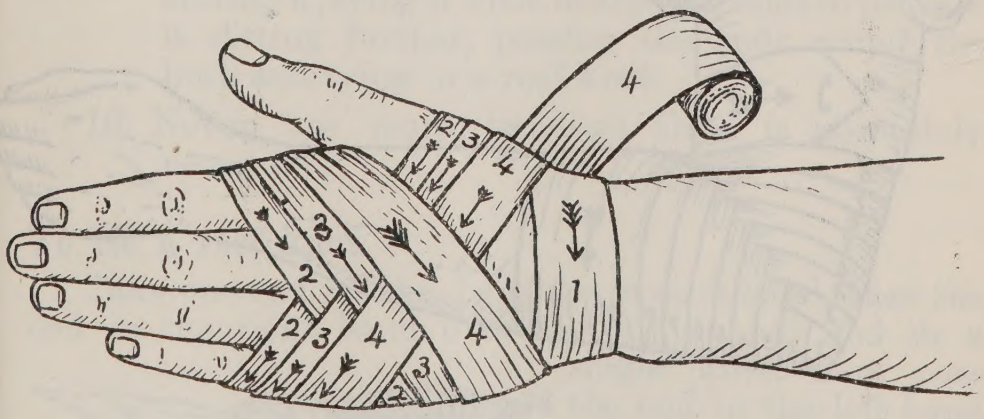


Fig. 149.

Figure of Eight Bandage.

within outwards and round the back again, thus forming a series of loops like the figure eight. This is specially

designed for bandaging joints, but can be applied to any part of a limb.

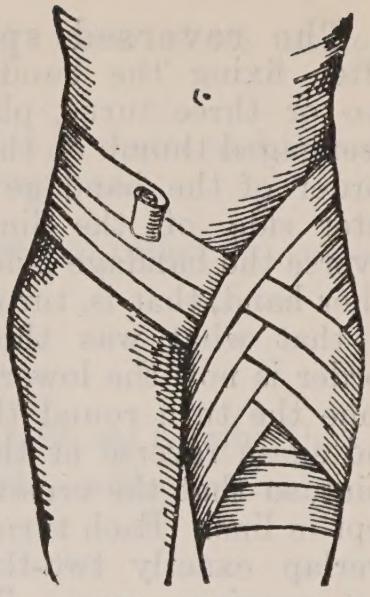


Fig. 150.
Spica Bandage.
(R.A.M.C. Training.)

A Spica is a special form of figure of eight, used at the junction of a thin with a thick part, such as the arm or leg with the trunk, and the thumb with the wrist. A spica bandage may be applied **ascending** or **descending.**

A divergent Spica is used to cover the knee and elbow. A turn is taken round the centre of the joint and

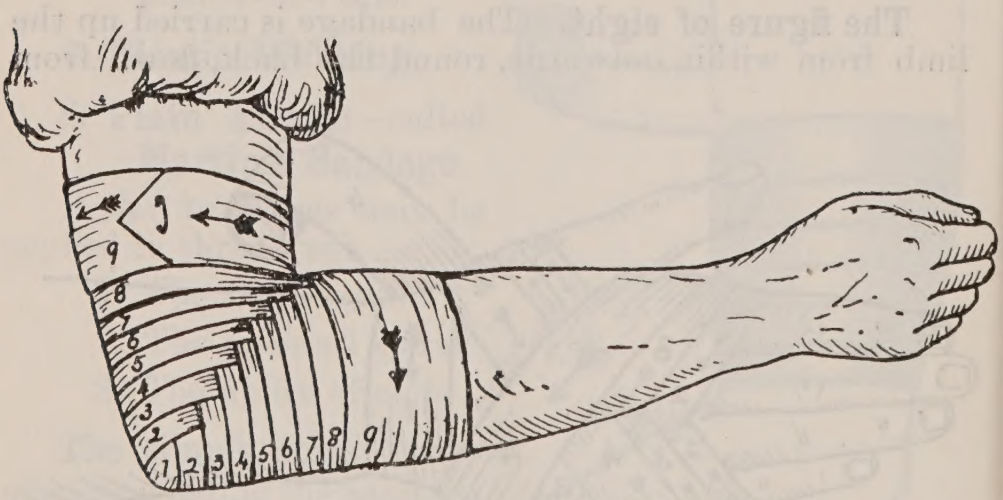


Fig. 151.
Divergent Spica Bandage.

then alternately above and below. This allows a certain amount of movement at the joint.

RULES FOR BANDAGING.

1. Fix the bandage by a few turns round the limb.
2. Bandage from below, upwards.
3. Bandage from within outwards over the front of the limb.
4. The crossings should be in line and slightly to the outer side of the limb.
5. Each turn should cover two-thirds of the previous turn.
6. Keep the bandage taut while winding it round the limb. Do not wind it round and then pull it tight; this moves the dressing and causes the patient pain.
7. Always place cotton wool between opposing skin surfaces, as when bandaging the arm across the chest.
8. Bandage the limb while in the position in which it is intended to be kept. Do not bandage it first and then put it in the correct position.
9. Fix the end of the bandage by pinning it, or by slitting it, tying a knot in the two ends to prevent it slitting further, passing the ends round the limb and tying in a reef knot.
10. Never use more bandage than is absolutely necessary.

To tie a reef knot.

Take one end of the bandage in each hand, pass the end in the right hand over that in the left and tie a single knot, then pass the end in the left hand over that in the right and complete the knot. The ends when pulled tight will lie parallel with the turns of the bandage.

Fig. 152.—Reef Knot.
(First Aid in the Royal Navy.)

In a *granny knot* the ends lie at right angles to the turns of the bandage and it is inclined to slip.

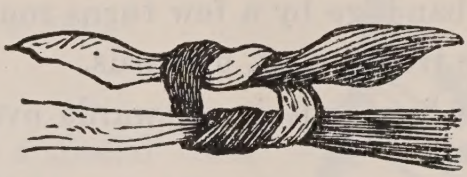


Fig. 153.
Granny Knot.
(First Aid in the Royal Navy.)

Remember the rule for tying a reef knot :—

"*Right over left : left over right.*"

3. SPECIAL BANDAGES.

Plaster-of-Paris Bandage.

These bandages consist of loose rolls of muslin into which dry plaster-of-Paris has been rubbed, and are packed in tins. They are used as splints.

The limb is washed, shaved and dried and then covered with a spiral bandage of domette, flannel or lint. A plaster bandage is stood on end in a bowl of warm water, deep enough to entirely cover it. When thoroughly wet it is removed, lightly squeezed and another put into soak. The first bandage is then applied to the limb in a series of spirals without any reverses. The second bandage is similarly applied, after placing a third one to soak, and so on until the splint is considered strong enough.

A thick paste of plaster and water is then made and rubbed over the last bandage to make a smooth and even surface.

During the application the limb is held by an assistant and afterwards it is propped up so as to allow air to pass underneath until dry. Hot-water bottles may be placed on either side to make it dry quickly.

To remove the bandage various shears and chain saws are made.

In some cases the bandages, while still wet, are cut down the front with a scalpel, and kept in position till

dry by an ordinary bandage. The splint is then removed and the cut edges bound with strapping. It is then replaced and kept in position by lacing, straps and buckles, or by a bandage.

To remove the plaster from the hands, rub them with a little moist sugar before washing.

T Bandage.

Two pieces of 4-inch roller bandage are fixed together by pinning or stitching to form the letter T. The

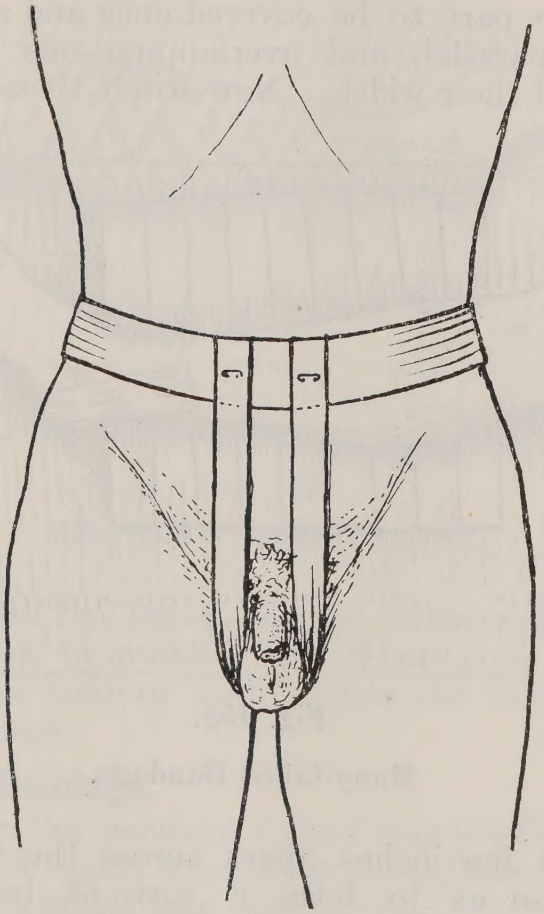


Fig. 154.
T Bandage.

horizontal part is tied round the waist, and the tail is carried from the back through between the legs, split as far back as the scrotum, and each end tied separately to the waist part.

A quicker method of connecting the two bandages is to fold over the vertical part for about 6 inches, and in this double part cut two parallel vertical slits 4 inches long. The horizontal part is passed through these slits and tied round the waist.

T bandages are used to keep dressings on the perineum, and in tying in a catheter.

Many-tailed Bandage.

Take several strips of bandage long enough to surround the part to be covered once and a half times. Lay them parallel, and overlapping one another for two-thirds of their width. Now stitch these together in

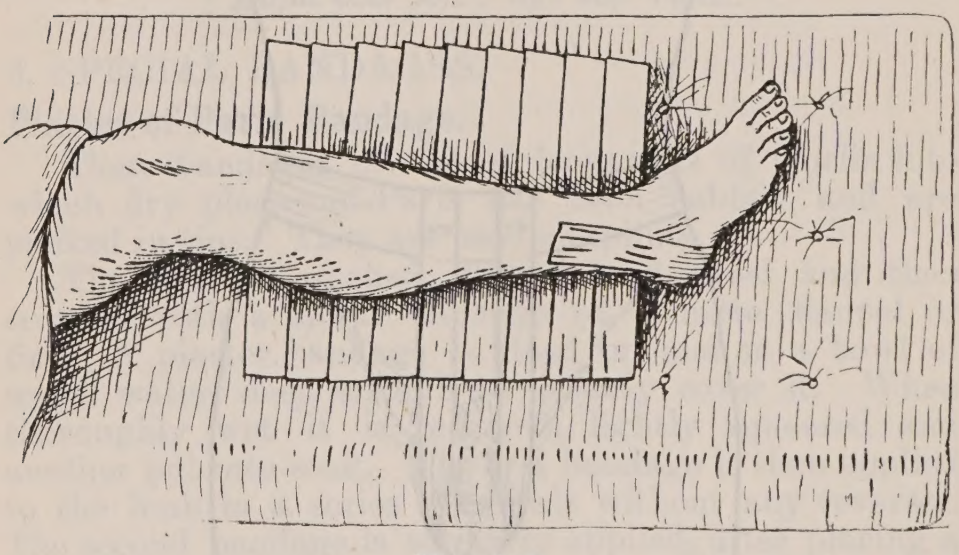


Fig. 155.

Many-tailed Bandage.

two lines a few inches apart across the width of the bandages, so as to form a sort of backbone with overlapping ribs at either side.

To apply it, the backbone is placed at the back of the part to be bandaged and the side pieces brought forward singly, each side in turn, and crossed over the dressing. The last turn is secured by a safety pin, and when completed the result resembles a reversed spiral bandage.

When used for the thorax, shoulder straps are often sewn to the upper part of the backbone of the bandage which are brought over the shoulders and pinned down in front. These prevent the dressing slipping downwards.

Similarly when used for the abdomen, two lengths of bandage are sewn to the lower part, brought forward between the legs, and pinned to the bandage in front.

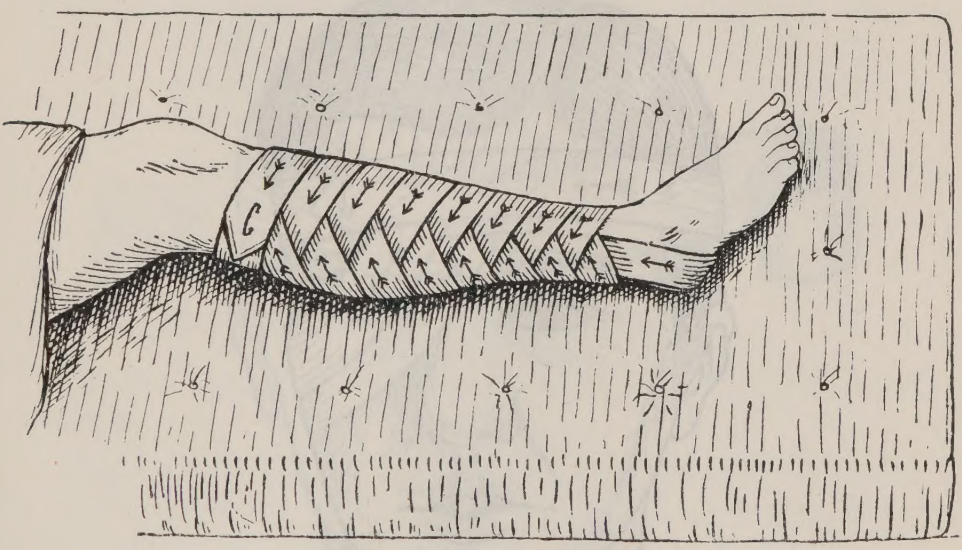


Fig. 156.

Many-tailed Bandage applied.

Many-tailed bandages are used when a dressing has to be changed frequently, and when it is inadvisable to disturb the body or limb to pass the many turns of a roller bandage.

Four-tailed Bandage.

A 3-inch roller bandage 1 yard long is split from both ends except for about 4 inches in the middle; and in the centre of this a small hole is cut.

To apply it, fit the chin into this central hole, tie the upper tails over the occiput to draw the chin back, and tie the lower tails at the top of the head to draw the jaw upwards. The four loose ends are then tied together to prevent the bandage slipping off the head.

This bandage is used in fracture of the lower jaw and to secure dressings.

Eye Bandage.

Using a 2-inch roller bandage take a turn round the head commencing at the temple of the sound side and passing across the forehead. The next turn crosses the eye to below the ear and over the back of the head.

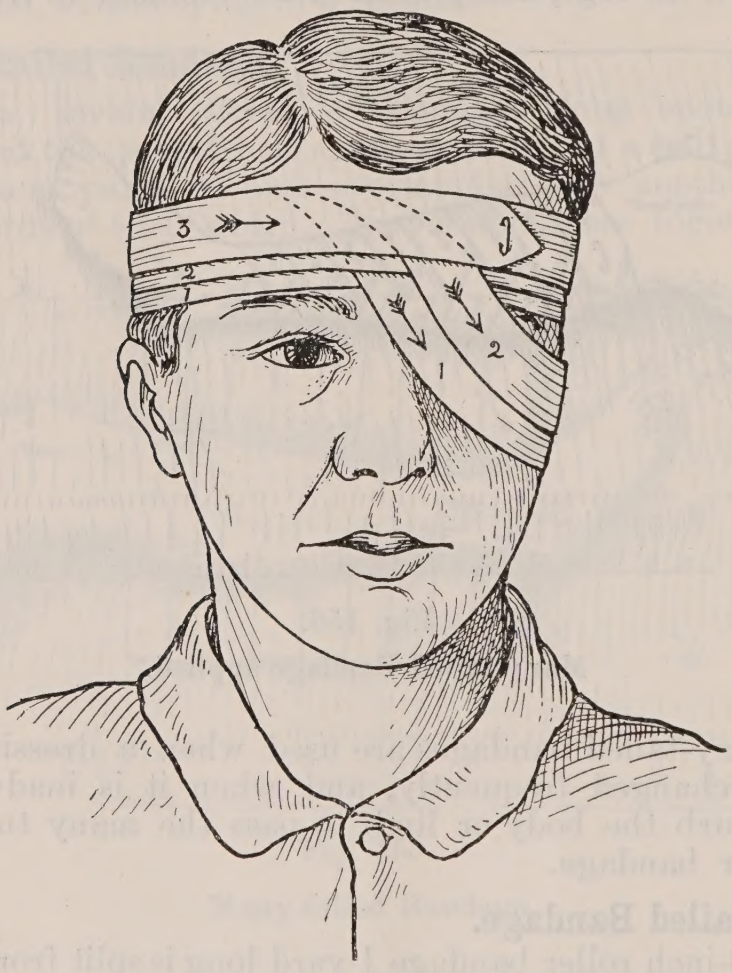


Fig. 157.

Eye Bandage.

The third turn is reversed over the eye, passes above the ear, round the back of the head and is pinned at the temple. It is wrong to take too many turns over the eye.

Capeline Bandage.

This is used to keep a dressing on the head and may be applied in two ways :---

(1) Take a 3-inch roller bandage and, commencing below the occiput, bring it over the centre of the skull to the eyebrows and then back again

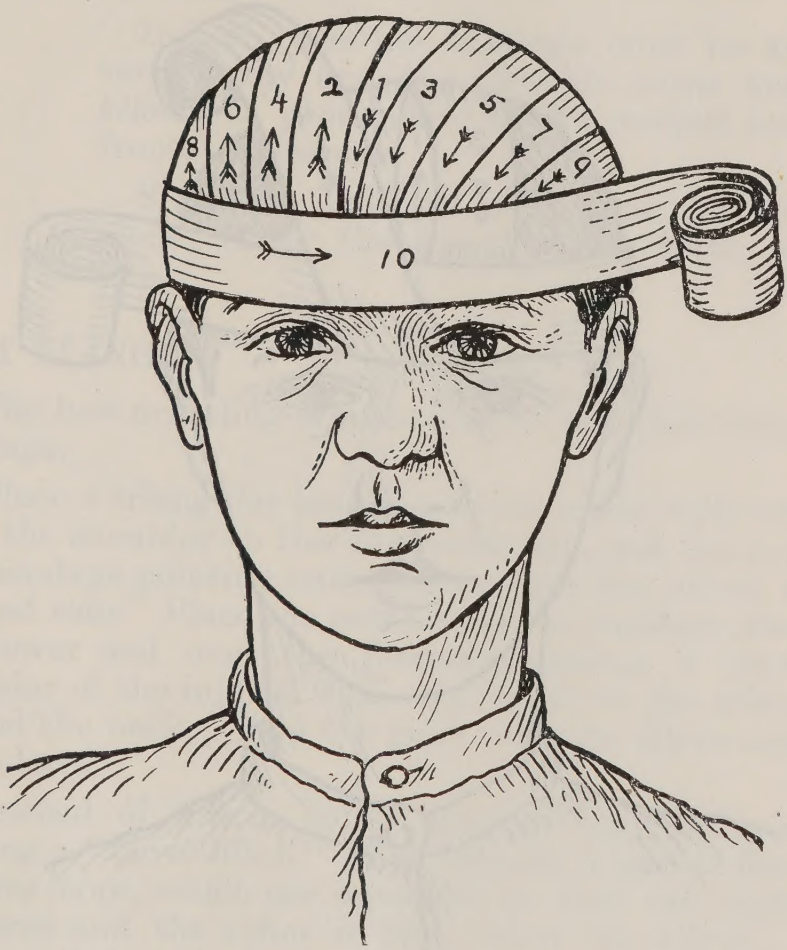


Fig. 158.

Capeline Bandage. First Method.

slightly to one side, overlapping two-thirds of the first layer. An assistant holds the back turns in place while you attend to those in front. Now bring the bandage to the front again, but on the other side of the centre strip, and so on, taking each side in turn until

the whole surface is covered. The loops thus formed are held in place by taking a few turns round the head, the end being pinned.

(2) Take two roller bandages, one 3-inch and one 2-inch, and pin or sew the ends together so that both unroll the same way. Place the

Fig. 159.

Capeline Bandage. Second Method.

united ends below the occiput, bring both bandages round to the front, and cross the narrow over the broad one. The latter is now taken back over the vertex while the former is continued round the head, and below the

occiput they are again crossed. This is continued until the scalp is covered, the narrow bandage passing round the head fixing the turns of the broad one which passes backwards and forwards over the vertex. The two bandages are then tied together in a reef knot in front.

In both cases the bandage must be applied very firmly and the circular turns must be *below* the prominence of the occiput and the frontal eminences.

Similarly, half the skull may be covered alone; either the front, or the back, or one side.

ARM SLINGS.

The best arm sling is made with an unfolded triangular bandage.

Place a triangular bandage on the chest with one end over the shoulder on the uninjured side, and the point of the bandage pointing outwards towards the elbow of the injured side. Place the arm across the bandage, turn up the lower end over the forearm, passing it over the shoulder of the injured side, and tie it to the other end behind the neck. Fold the point over the elbow and pin it in place.

Instead of this, a roller bandage may be used by forming a "clove hitch." The forearm is passed through the two loops, which are separated so that one supports the wrist and the other is just below the elbow. The ends are tied at the back of the neck.

FOOT SLINGS.

A length of stout bandage is passed round the sole of the foot and the ends tied at the back of the neck. It is used to support the leg when the patient is allowed to walk about with crutches after a fracture. It should be tight enough to keep the foot in front of the body, so as to prevent it touching the ground.

CLOVE HITCH.

To tie a clove hitch, hold a length of bandage near its centre in the right hand, palm downwards. Grasp the nearest part of the bandage with the left hand, the back of which must face the right with the little finger upwards. Now turn the left hand outwards and the right hand inwards, when two loops will be formed. Place the right hand loop in the fingers of the left hand, grasp the loose ends with the right hand and the clove hitch is made. This may seem rather complicated, but is quite easy in practice. The advantage of a clove hitch is that when the ends are pulled on the loops do not tighten.

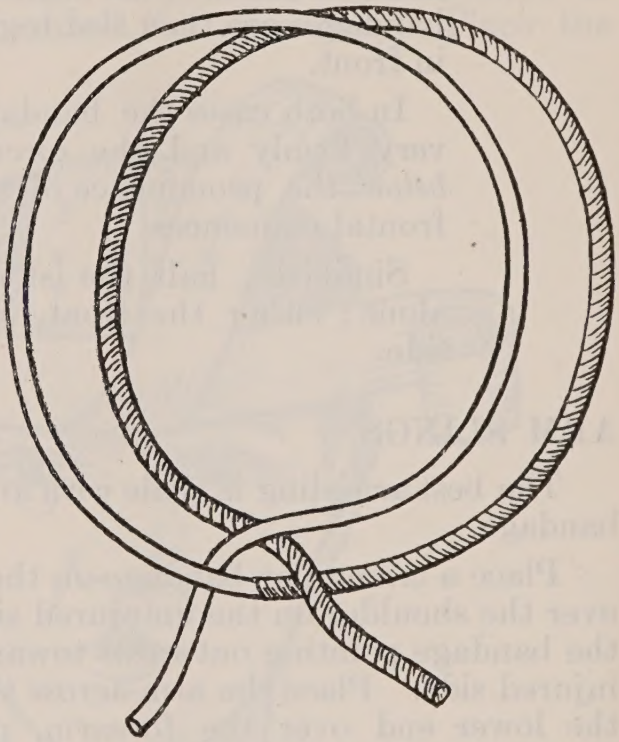


Fig. 160.
Clove Hitch.

STRAPPING.

Adhesive strapping is used to draw the edges of a wound together, to fix dressings in place, to fix splints, to fix limbs, to attach weights to a limb, and for many other purposes. Before applying strapping it should be warmed either by holding it before a fire or by holding the non-adhesive side against a basin or can of hot water. It may also be made to stick readily by moistening the adhesive side with turpentine applied on a swab.

SCOTT'S DRESSING.

This is most commonly applied to the knee, in cases where fluid has collected in the joint (Synovitis).

Unguentum Hydrargyri Co. is spread on lint which is afterwards cut into strips long enough to go once and a half times round the limb, and not more than 2 inches in width.

The first strip is applied well below the joint, the centre being at the back of the limb and the ends crossed over the front. The next strip is applied in a similar way, but above, and overlapping one-third of, the first; and so on until the whole joint is completely covered. Over these are placed strips of strapping in exactly the same way, the last piece being wound circularly round the top of the dressing to make a neat finish. A divergent spica bandage is applied over all.

This dressing is left on for a week or more and is then renewed.

SPLINTS.

Material.

Splints are made of wood, metal (iron, zinc, lead, and tin), poroplastic felt, leather, gutta-percha, stout cardboard, or plaster-of-Paris.

Plain Wooden Splints are made in various sizes, from the very small ones for a finger to the large ones which are used as side splints for the leg.

Gooch's Splinting consists of narrow strips of wood glued on one side only to a piece of "American" cloth.

Fig. 161.
Gooch's Splinting.

It can therefore be bent in one direction and is often used to surround a limb.

Metal Splints are also made in various sizes and may be used for the same purposes as the wooden splints.

Poroplastic Felt is a thick felt which becomes soft and flexible when soaked in hot water. It is cut to the required shape, soaked in hot water, and moulded to the part. When dry and cold it becomes stiff, and is then firmly bandaged to hold it in place.

Leather and **Gutta-percha** are used in a similar manner.

Stout cardboard may be used when a small bone, such as a phalanx, is broken; or it may be used to strengthen a plaster-of-Paris splint.

Plaster-of-Paris has been described under Bandages.

Certain special splints are known by the names of their inventors. The chief of these are:—

Splint.	*Use.*
Carr's Splint.	Colles' Fracture.
Wilkinson's Triangular Splint.	Fractured Humerus.
Liston's Long Splint.	Fractured Femur.
Hodgen's Wire Splint.	,, ,,
McIntyre's Splint. (*See* Fig. 162, page 281.)	Fractured Tibia and Fibula.
Neville's Splint.	,, ,, ,,
Guy's Splint. (*See* Fig. 163, page 281.)	,, ,, ,,
Amesbury's Box Splint. (*See* Fig. 164, page 281.)	Fractured Tibia and Fibula or Patella.
Cline's Splint.	Pott's Fracture.
Roughton's Splint.	,, ,,
Dupuytren's Splint.	,, ,,

A Box Splint consists of a plain wooden back splint with a foot-piece, and two plain wooden side splints. It is very largely used in fractures of the tibia and fibula.

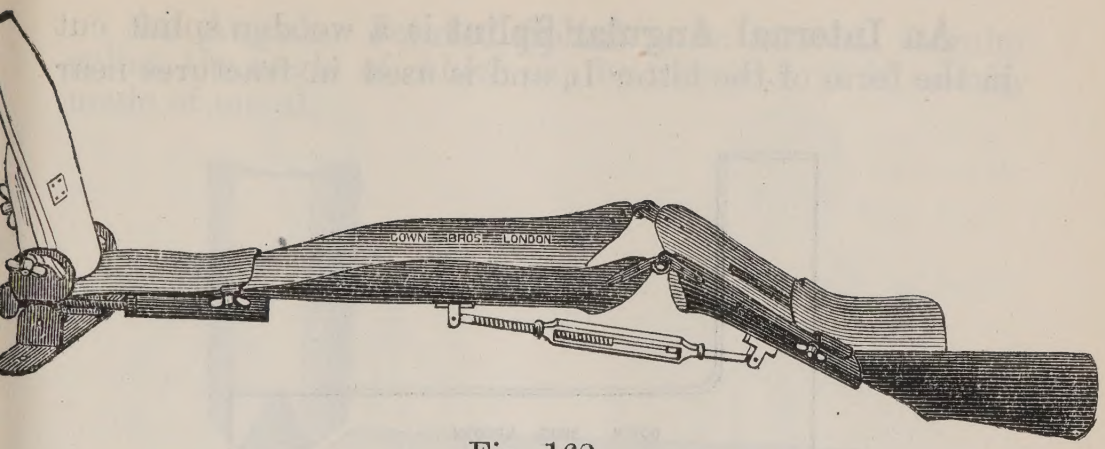


Fig. 162.

McIntyre's Splint.

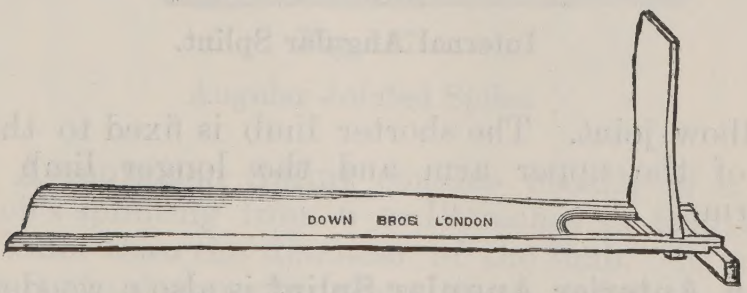


Fig. 163.

Guy's Splint.

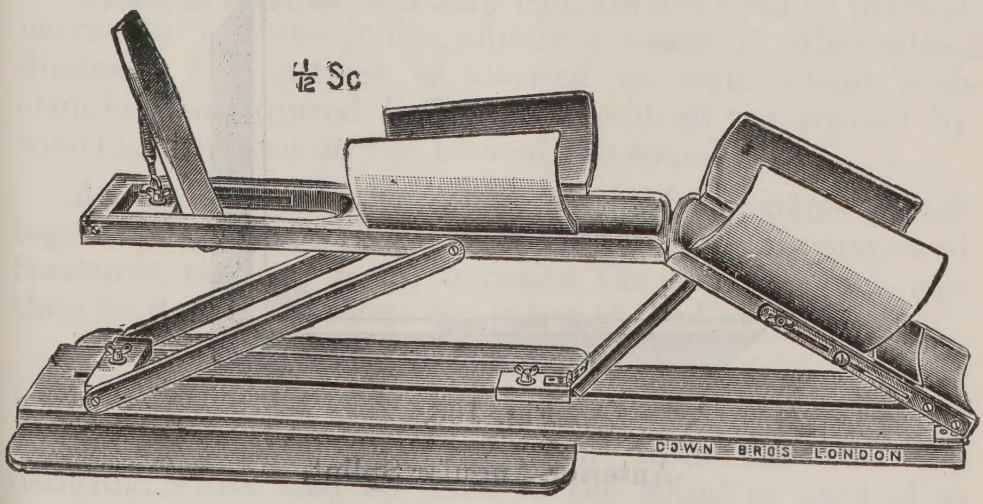


Fig. 164.

Amesbury's Splint.

An Internal Angular Splint is a wooden splint cut in the form of the letter L, and is used in fractures near

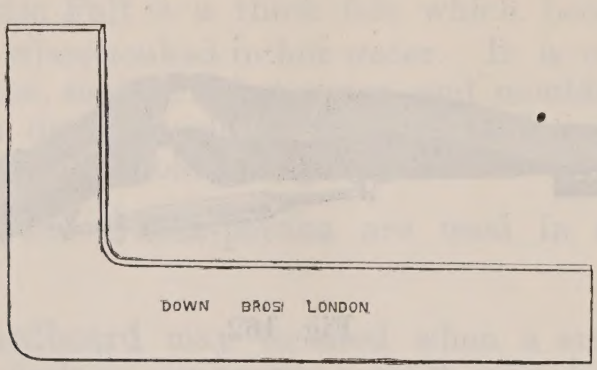


Fig. 165.

Internal Angular Splint.

the elbow joint. The shorter limb is fixed to the inner side of the upper arm and the longer limb to the forearm.

An Anterior Angular Splint is also a wooden splint made in the form of the letter L, but with the flattened

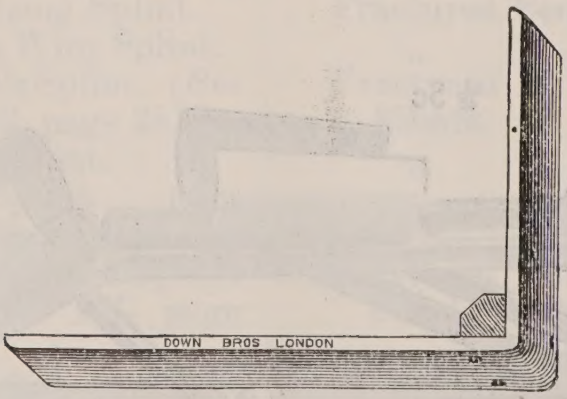


Fig. 166.

Anterior Angular Splint.

sides adjacent. It is used in fractures near the elbow joint, but is placed on the front of the limb.

An Angular Jointed Splint is an internal angular splint, the angle of which can be altered. It is usually made of metal.

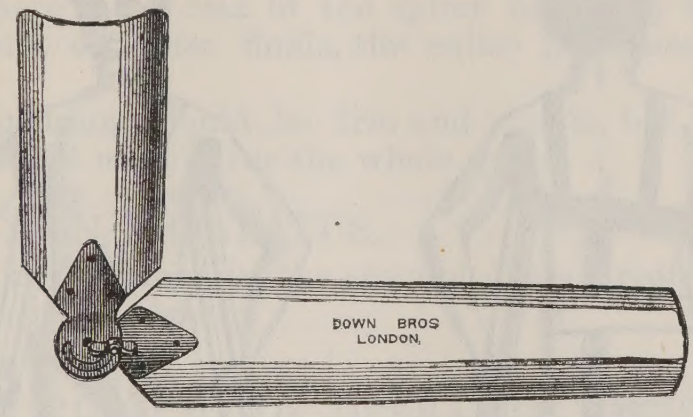


Fig. 167.

Angular Jointed Splint.

An Amputation Splint consists usually of a piece of Gooch's splinting from 6 to 12 inches in length and rather wider than the diameter of the limb. It is used to support the stump after amputation, and is bandaged to the posterior surface of the limb after the dressings have been applied.

Thomas's Knee and **Hip Splints** are used to prevent movement of these joints, chiefly in cases of tuberculous disease. The patient is allowed to walk about with crutches, the injured limb being kept off the ground by wearing a patten on the boot of the sound side.

An Interrupted Splint consists of two parts joined together by a metal bar. It is used in cases of compound fractures, the bar being opposite the wound, which can then be dressed without removing the splint.

PADDING SPLINTS.

Splints are always separated from the limb by padding, which may be fixed to the splint or applied to the limb.

To pad a splint, take a roll of tow, tease it well, enclose it in non-absorbent or carded wool, and place

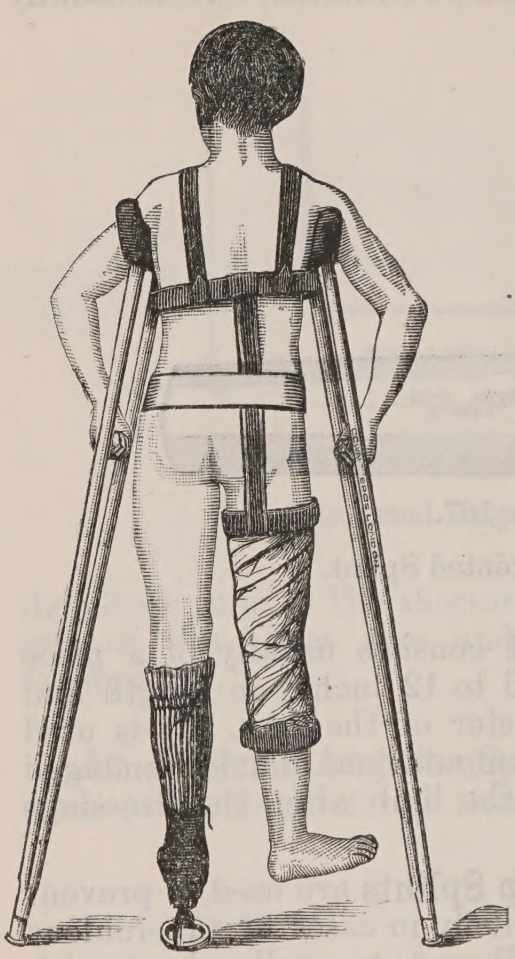


Fig. 168.

Thomas's Knee Splint.

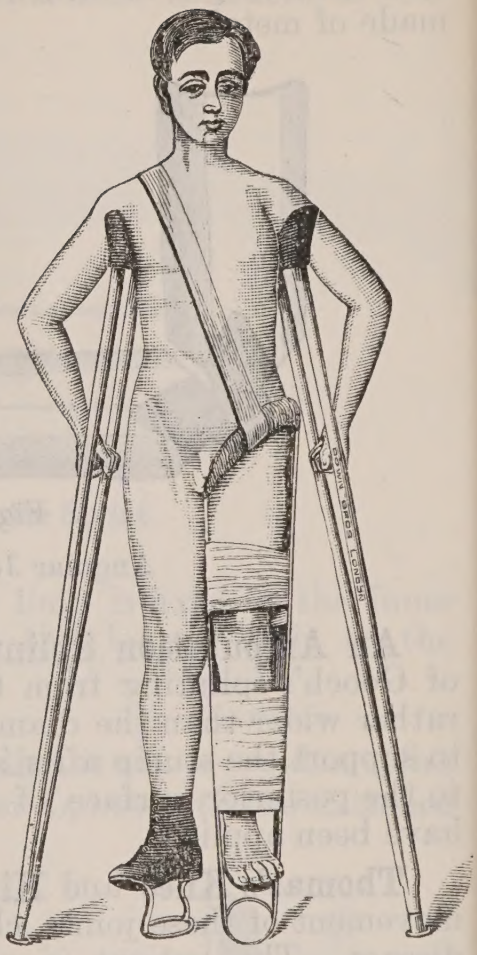


Fig. 169.

Thomas's Hip Splint.

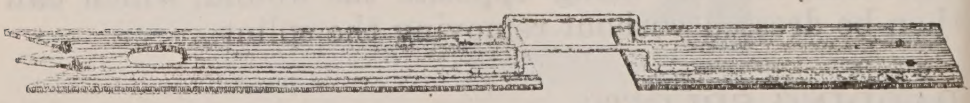


Fig. 170.

Interrupted Liston's Splint.

it on the splint. It is held in place by stitching a piece of calico over both the pad and the splint, the stitches being on the opposite side to the padding. When there is any risk of the splint becoming wet with blood, pus, or other fluids, the calico is covered with jaconet.

The padding should be firm and elastic, but without lumps, and it must cover the whole splint.

EXTENSION APPARATUS.

This is described in the account of the treatment of Fracture of the Femur.

THE NURSING OF OPERATION CASES.

1. PREPARATION OF THE PATIENT.

The patient is kept in bed for a few days, in some cases on low diet; and on the last day a specimen of the urine is saved and sent for examination. The evening before the operation he is given a purgative, Oleum Ricini 1 oz. or Mist. Alba 1 oz., and a simple enema next morning. About four hours before the operation he is given half a pint of beef tea, after which nothing more is allowed. *This is of the utmost importance, and the nurse must see that this rule is strictly carried out.* Just before going into the operating theatre the patient should be encouraged to pass urine. If he has false teeth, they must be removed and kept in a safe place.

Except in very trivial cases the patient should be carried or wheeled to the theatre, and not allowed to walk.

The bed ticket and temperature chart should accompany the patient.

2. PREPARATION OF THE PATIENT'S SKIN.

The patient should have a hot bath, where possible, on each of the previous three days.

There are two methods of preparing the skin, but the details of each vary considerably. Learn the method practised by the Medical Officer in charge of the case, and follow his rules.

The following are given only as a basis on which to work :—

First Method.

1. See that the dressing trolly is complete in every detail.

   Required :—Razor, ether soap, sterile water (hot and cold), spirit biniodide lotion, sterilised towels, swabs, gauze, lint, wool, bandages, and india-rubber gloves.

2. Thoroughly scrub your hands in hot water and soap, paying special attention to the finger nails, then in biniodide of mercury lotion (1—3000). Put on the sterilised gloves.

3. The patient's skin is then shaved for at least 6 inches around the site of the operation, ether soap and water being used with pads of wool—not a brush.

4. The skin is then washed with ether soap and water, and all loose hairs removed.

5. Dry the skin with cotton wool.

6. Swab it over with Spirit Biniodide Lotion.

7. Wash off the Lotion with warm sterile water.

8. Apply a dry pad of sterilised gauze, cover with cotton wool, and bandage.

This procedure is carried out the day before the operation and is repeated in the morning.

Second Method.

The patient has a bath the night before, after which water is not applied to the skin in any way. On the morning of the operation the skin is prepared as follows :—

1. Prepare the dressing trolley with a razor, sterilised towels, gauze, wool, bandages, and gloves, Acetone and a $2\frac{1}{2}$ per cent. solution of Iodine in rectified spirit.

2. The nurse prepares his hands as before.

3. The skin is *dry* shaved.

4. The skin is well rubbed with Acetone for 5 minutes. This removes all moisture from the skin.
5. The skin is swabbed over with the Iodine Solution.
6. Apply a dry pad of sterilised gauze, cover with cotton wool, and bandage.

This procedure is repeated when the patient is put on to the operating table.

In cases of emergency either method may be used, but the Iodine Method is the safer. The preparation may be carried out in the ward, or after the patient is anæsthetised and on the operating table. If the part is very dirty, such as the hand or foot, it must be scrubbed with a nail brush. Turpentine is specially useful in removing grease and dirt.

3. PREPARATION OF THE BEDDING.

The bed into which the patient will be put after the operation must be made up with clean bedding, the sheets being sterilised.

The upper bed-clothes are folded lengthways to one side of the bed, so that the patient can be placed straight on to the bed and the clothes turned over him.

Two hot-water bottles are required, one placed where his back will rest and the other at the foot.

One pillow only is placed at the head.

See that there is a towel and receiver ready, and screens to surround the bed.

4. TREATMENT OF THE PATIENT AFTER THE OPERATION.

The stretcher containing the patient is brought to the side of the bed, on to which he is gently lifted, the hot-water bottle in the the centre having been removed. Care must be taken not to disturb the dressings or splints.

He is then covered with the bed-clothes, the head turned to one side and a towel placed under the chin. If the dressings are on the upper part of the body turn the head to the opposite side.

Never leave the patient for a moment, until he has recovered consciousness and the vomiting has ceased.

Watch the pulse, the breathing, the colour of the face, and the dressing.

5. POST-ANÆSTHETIC VOMITING.

Vomiting almost always occurs after the administration of a general anæsthetic, and, as the patient may be still unconscious, asphyxia is very liable to occur through some of the vomit passing into the trachea.

When vomiting occurs, turn the patient's head to one side so that the vomit will run out of the side of his mouth; place the fingers behind the angle of the jaw and press it forward; hold a receiver under the mouth.

When each attack of vomiting is over clean out the mouth with a swab on a handle, remove the receiver, and change the towel if soiled.

Persistent vomiting is treated by giving sips of hot water with a teaspoon.

6. SHOCK.

Every operation causes a certain amount of shock, but no special treatment beyond rest and warmth are necessary unless the pulse is much affected.

Rest and warmth are the best means of preventing shock.

The signs and treatment are described on page 208, but are again tabulated here.

Signs.

Subnormal temperature, feeble irregular pulse, shallow respirations, face pale, cold clammy sweat, pupils dilated, restlessness.

Treatment.

(*a*) Absolute rest and quiet in a darkened room.

(*b*) The head low and the foot of the bed raised on blocks.

(*c*) Warmth—hot bottles and extra blankets.

(*d*) Stimulants— as ordered by the Medical Officer.

(*e*) Saline Infusion.

7. FEEDING THE PATIENT AFTER OPERATION.

This depends upon the nature of the operation and the wishes of the Medical Officer.

(*a*) Ordinary Cases.

The general rule is, *never give any food by the mouth until the vomiting has ceased.* Then small quantities—1 or 2 ounces—of milk and soda-water are given, and the quantity gradually increased. Next day Low Diet may be allowed, and two days later Full Diet.

(*b*) Abdominal Cases.

The orders of the Medical Officer must be implicitly obeyed, but the following will give some idea of the routine :—

For the first 12 hours	-	sips of hot water only, to relieve the thirst.
For the next 6 hours	-	beef tea, barley water, tea or raisin tea, $\frac{1}{2}$ to 1 ounce every 2 hours.
For the next 6 hours	-	the same, but in quantities of from 2 to 4 ounces.
On the second day	-	one egg is added.
On the third day -	-	custard pudding, milk, jellies or Benger's Food.
On the fifth day -	-	fish.
On the seventh day	-	chicken.

In some cases rectal feeding alone is carried out for the first few days.

CARE OF THE DEAD.

The chief signs of approaching death are :—

Feeble action of the heart.
Feeble respirations.
Increasing coldness and pallor of the skin.
Picking at the bed-clothes.

When the Medical Officer has pronounced the patient dead, close the eyelids and cover them with pads of damp wool to keep them closed, raise the lower jaw and keep it in that position by means of a bandage, and straighten the limbs. Turn the upper sheet over the face.

About an hour later, the whole body is washed with soap and water, the ankles and big toes are tied together, fresh dressings are applied to any wounds, and the rectum is plugged with cotton wool. The hair is brushed, and, if there is any oozing from the mouth or nostrils, these cavities are also plugged. The shroud is put on and the body is completely covered with a sheet.

If the nurse has a wound on his own hand it must be covered with a waterproof dressing before touching the dead body, as very poisonous germs soon develop in the latter.

When in the presence of the dead always behave as you would if your late patient's relations were also present.

Chapter XII.

FEVERS.

By Fever we mean a rise in the temperature of the body accompanied by a general disturbance of the health.

Some Fevers are infectious, that is, they may be conveyed from one person to another; and it is probable that all fevers are due to germs.

Degrees of Fever.

Normal Temperature - -	from 97·8° to 99° (average 98·4°).
Moderate Fever - - -	„ 99° to 103°
High Fever - - - -	„ 103° „ 105°
Hyperpyrexia - - -	over 105°
(Subnormal Temperature	- below 97·8°.)

Types of Fever.

(1) **Continued Fever,** where there is a variation of *less* than 2 degrees between the morning and evening temperatures which do *not* come down to normal.

(2) **Remittent Fever,** where there is a variation of *more* than 2 degrees, and the temperature does *not* come down to normal.

(3) **Intermittent Fever,** where there is a variation of *more* than 2 degrees, but the temperature *does* come down to normal at least once in every 24 hours.

Terminations of Fever.

(1) By **crisis,** where the temperature comes down suddenly.

(2) By **lysis**, where the temperature comes down gradually.

Means of Reducing the Temperature of the Body.

(1) By the external application of cold.

(*a*) Cold bath.
(*b*) Cold sponge.
(*c*) Tepid sponge.
(*d*) Cold pack.
(*e*) Ice pack.
(*f*) Ice cradle.

(2) By the action of drugs.

(*a*) Antipyrine.
(*b*) Antifebrine.
(*c*) Phenacetine.
(*d*) Quinine.
(*e*) Sodium Salicylate.
(*f*) Aconite.

INFECTIOUS FEVERS.

1. Those common in the British Isles.

(1) **Those accompanied by a rash.**

Chicken-pox or Varicella.
Scarlet Fever.
Small-pox.
Measles or Morbilli.
Rubella or German Measles.
Typhus Fever.
Enteric or Typhoid Fever.

(2) **Those not accompanied by a rash.**

Mumps.
Whooping Cough.
Diphtheria.
Influenza.

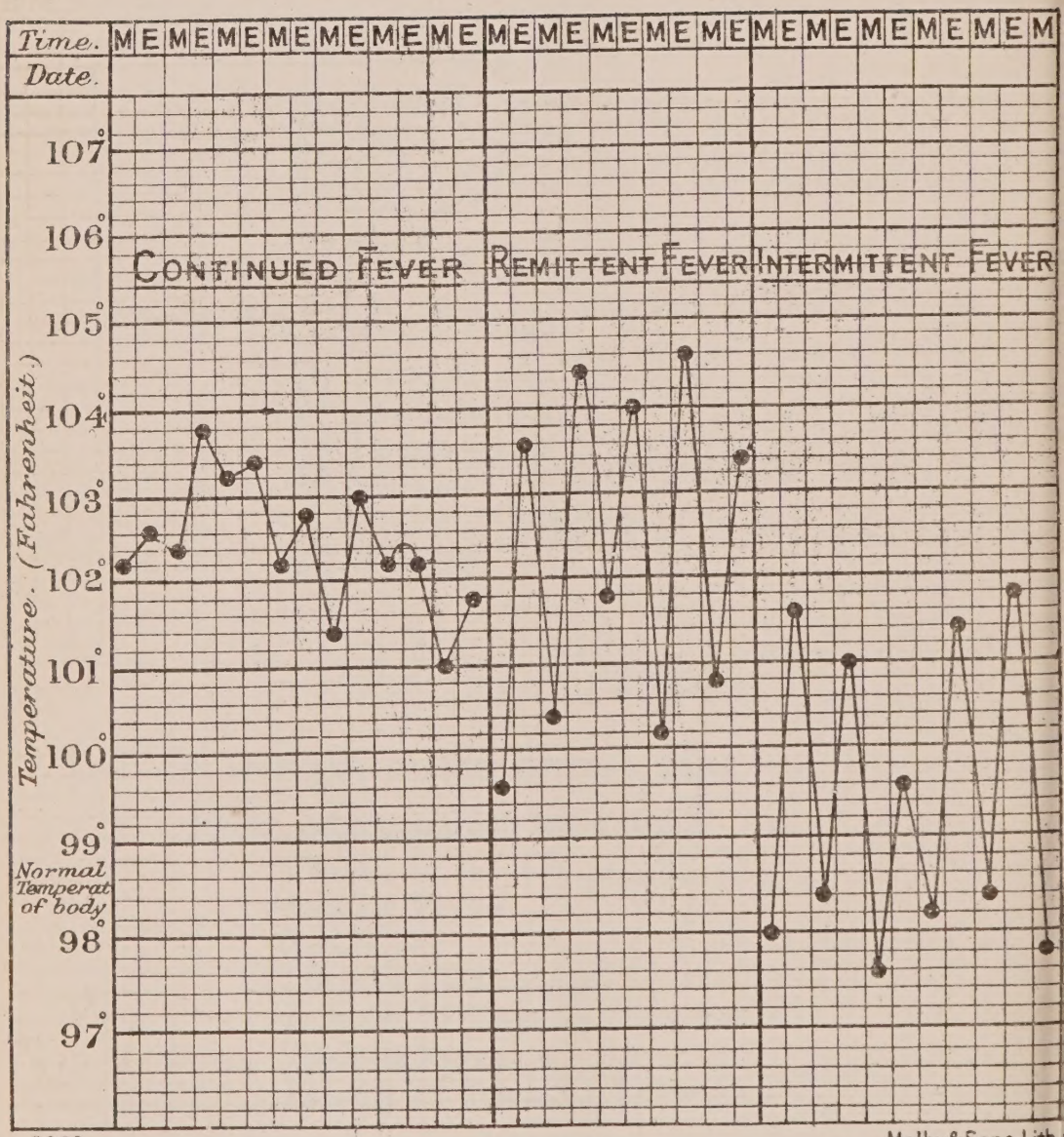

Time.
Date.
M E M E M E M E M E M E M E M E M E M E M E M E M E M E M
Temperature. (Fahrenheit.)
107°
106°
105°
104°
103°
102°
101°
100°
99°
Normal Temperat of body
98°
97°
CONTINUED FEVER
REMITTENT FEVER
INTERMITTENT FEVER
2933.
Malby & Sons, Lith

Fig 171.

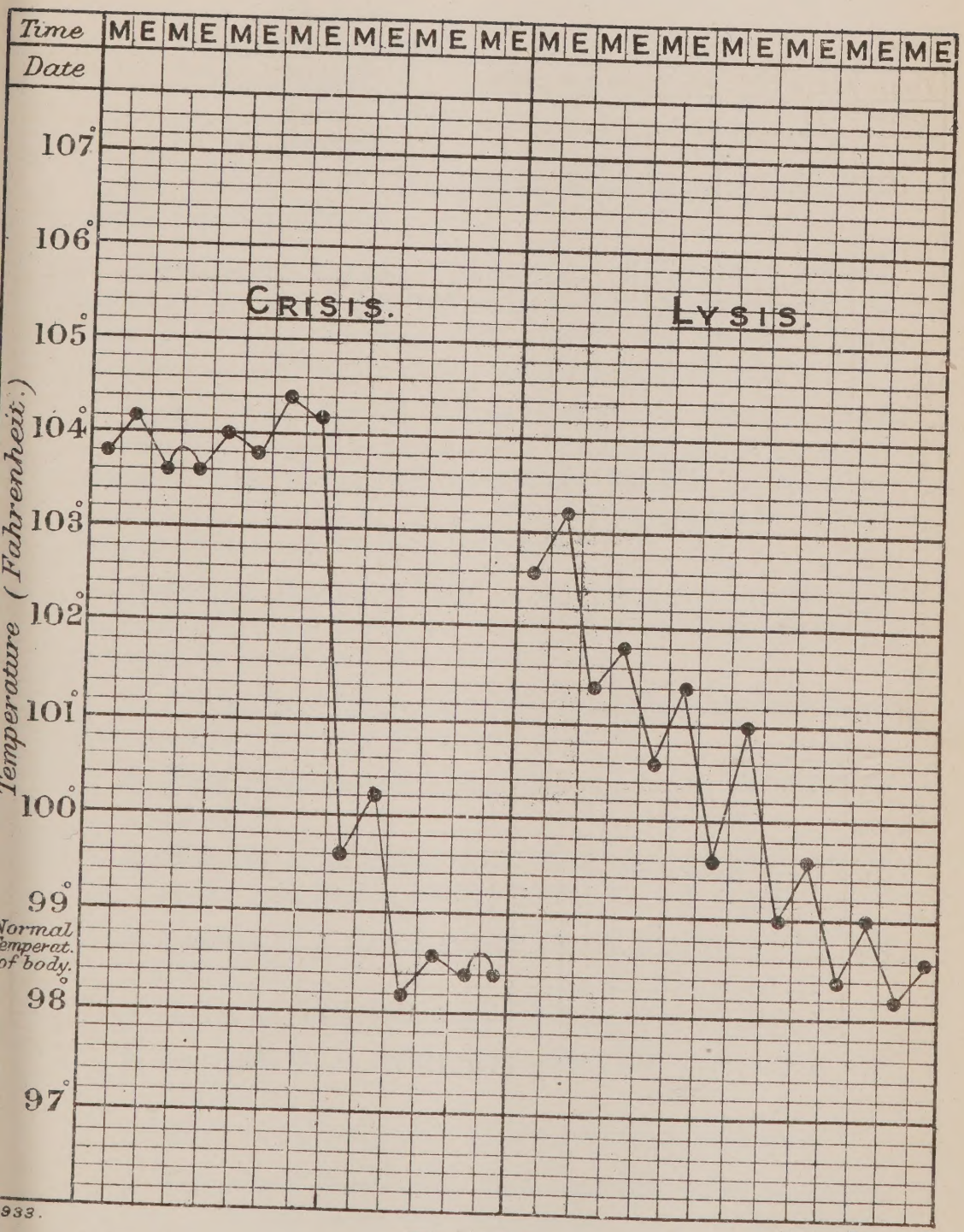


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Fig. 172.

Malby & Sons, Lith.

2. Those met with abroad.

Malta or Mediterranean Fever.
Malaria.
Cholera.
Dysentery.
Plague.
Yellow Fever.
Dengue.

In dealing with Infectious Diseases the following terms are employed :—

Incubation Period.—This is the time which elapses between the date of infection and the appearance of the first symptom. During this period the germs of the disease are growing and multiplying in the body.

Quarantine Period.—This is the time during which apparently healthy people are isolated after being in contact with a case of infectious disease, to see if infection has occurred. This period is always 2 or 3 days longer than the Incubation Period.

Isolation Period.—This is the time during which a patient suffering from an infectious disease is isolated, because he is infectious to others.

In describing the rash which accompanies Infectious Fevers, the following terms are used :—

A Papule or pimple is a small red solid elevation of the skin.

A Macule is a small spot of congested skin. It is larger and flatter than a Papule.

A Vesicle is a small collection of serum under the epidermis.

A Bulla or bleb is a large Vesicle.

A Pustule is a small collection of pus under the epidermis.

A Scab is an irregular mass of dried serum or pus.

In Infectious Fevers the rash appears after a certain definite interval from the commencement of the illness,

and to remember the day on which the rash appears, the following "tip" may be used :—

Learn this sentence : "*Very Sick People Must Take No Exercise*," and apply it thus :—

Tip.	*Disease.*	*Day on which Rash usually appears.*	
1. **V**ery -	**V**aricella -	1st day of illness.	
2. **S**ick -	**S**carlet Fever	2nd „ „	
3. **P**eople -	Small **P**ox -	3rd „ „	In Rubella the rash appears on the 3rd or 4th day.
4. **M**ust -	**M**easles -	4th „ „	
5. **T**ake -	**T**yphus Fever	5th „ „	
6. **N**o -	(**N**o disease).		
7. **E**xercise	**E**nteric Fever	7th „ „	

Infection is spread in various ways: by actual contact, by the air, food, or drink, clothing, books, utensils, &c.

The most infectious part of a patient may be his breath, saliva, urine or fæces, discharges from the throat, nose, or ears, or the scales of skin which come away during desquamation or peeling.

Prevention of the Spread of Infection.

1. Isolation.

As soon as a case is suspected of being infectious, the patient is kept away from others. In hospital or barracks he is at once removed to the isolation ward; in a ship. any suitable space must be employed, such as a spare cabin, the chain-locker flat, a boat roofed over with a tarpaulin, &c., until he can be sent to hospital.

The nurse attending an infectious case must not mix with other patients or nurses.

The patient must have his own utensils (cup, plate, knife, fork, spoon, &c.), and, except when in a proper isolation ward, use a commode and urinal, instead of the general W.C.

Isolation must be complete, so that there is no possible means by which infection can be carried to others.

2. Disinfection.

By disinfection is meant the killing of the germs of the disease. This is carried out by heat, by chemicals, or by fresh air and sunlight.

(1) Disinfection by Heat.

Boiling in water is the best and surest method of disinfection, but it cannot, of course, be used for every infected article.

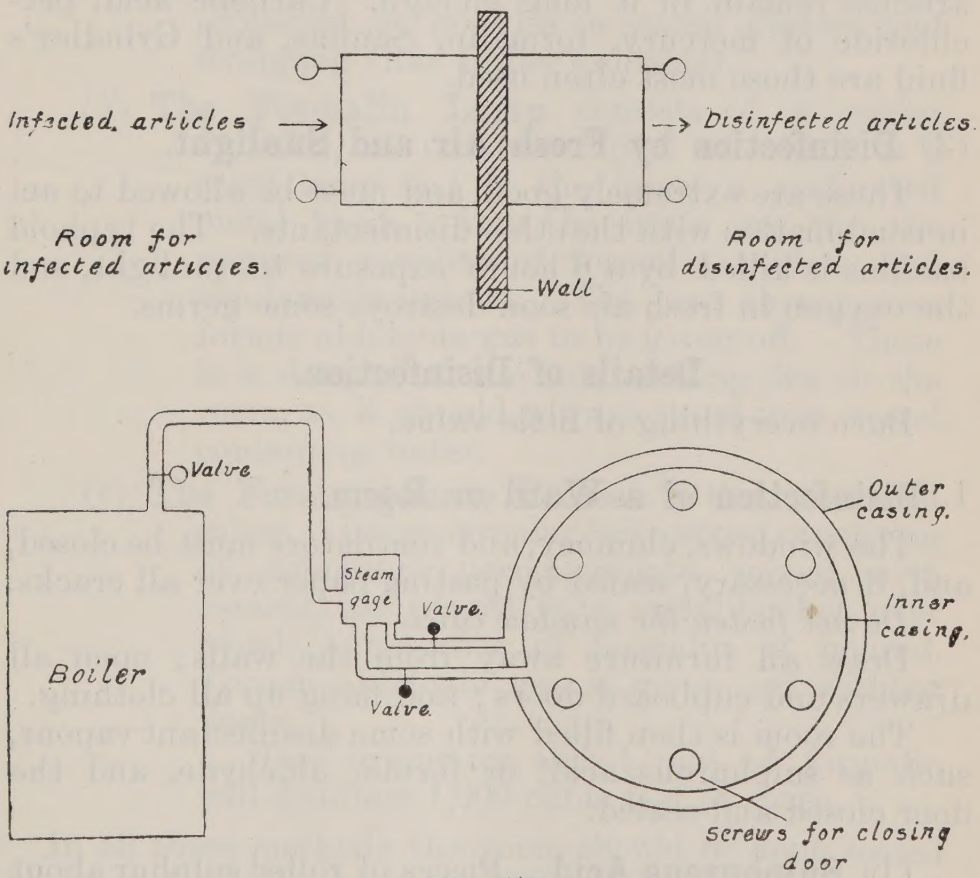


Fig. 173.
Diagram of Steam Disinfector.

For bedding and clothing a steam disinfector is used. This consists of two large metal cylinders, one inside the other, leaving a space between, and closed at the ends by hinged doors. It is built into a wall between two rooms, so that the end doors open into separate rooms, one of which may be called the infected, and the other the clean room. The articles to be disinfected are put into the inner chamber, through the door in the infected

room, and both doors closed. Steam is then turned into both the inner and outer cylinders, so that the steam in the inner chamber, being under pressure, attains a temperature of about 240°. After about 30 minutes the articles are removed by the door in the clean room.

(2) Disinfection by Chemicals.

Any strong antiseptic may be used provided the articles remain in it long enough. Carbolic acid, perchloride of mercury, formalin, Sanitas, and Grindley's fluid are those most often used.

(3) Disinfection by Fresh Air and Sunlight.

These are extremely good, and must be allowed to act in combination with the other disinfectants. The typhoid bacillus is killed by a 6 hours' exposure to sunlight, and the oxygen in fresh air soon destroys some germs.

Details of Disinfection.

Burn everything of little value.

1. Disinfection of a Ward or Room.

The windows, chimney, and ventilators must be closed, and, if necessary, sealed by pasting paper over all cracks.

Do not fasten the window catch.

Draw all furniture away from the walls; open all drawers and cupboard doors; and hang up all clothing.

The room is then filled with some disinfectant vapour, such as sulphurous acid, or formic aldehyde, and the door closed and sealed.

(1) **Sulphurous Acid.**—Pieces of rolled sulphur about the size of lump sugar are placed in an iron vessel, moistened with methylated spirit, and ignited. The vessel should stand in another containing water, and be placed as high in the room as possible. From 2 to 3 lbs. of sulphur should be used for every 1,000 cubic feet of space.

Disadvantages.—Sulphur bleaches coloured articles; it tarnishes silver; it may not all burn out; the room may be set on fire.

(2) **Formic Aldehyde** is used in three ways.

(*a*) **The Formalin Spray.**—A solution consisting of:—

*Formalin, ℥ iv
Glycerine, ℥ v
Water, C i

is sprayed over the walls through a hose pipe. The eyes of the operator must be protected by goggles or watch glasses and strapping (like Buller's shields).

(*b*) **The Formalin Lamp** consists of a copper cylinder, in the lower part of which is a spirit lamp and in the upper a perforated metal basin. Into the basin are put the required number of formalin tablets, and the lamp is lighted. The heat then causes formic aldehyde gas to be given off. There is a danger of the lamp setting fire to the room, so it should always stand in a vessel containing water.

(*c*) **The Formanganate Process** is the latest and safest. Large circular briquettes, consisting of potassium permanganate mixed with cement, are placed in a metal bucket, over which a quantity of formalin is poured. Formic aldehyde gas is given off without flame.

Two briquettes and 1 pint of formalin will disinfect 1,000 cubic feet of space.

In all these methods the room should be kept sealed for from 6 to 24 hours, after which the doors and windows are opened. On entering the room the eyes should be protected and a wet towel tied over the nose and mouth. The reason for not fastening the window catch is now seen; it prevents delay in opening the window. When the disinfectant vapour has escaped, the floor, walls and furniture are washed with perchloride of mercury (1–1,000), and all clothing and bedding sent

* Formalin is a solution containing 40 per cent. of formic aldehyde in water.

to the disinfector. In a house, the paper may be stripped from the walls and burnt, and the room re-papered and the ceiling whitewashed.

2. **Disinfection of Bedding, Clothing, &c.**

These are usually put through the Steam Disinfector. Sheets, &c. which have become stained with the patient's excreta must be soaked in water or some disinfectant (*not Perchloride of Mercury*) before being sent to the Disinfector, otherwise the stains will become fixed.

If a Steam Disinfector is not available, mattresses, beds, pillows, blankets, curtains, carpets, &c. may be treated with formic aldehyde in a small closed room, and bed- and body-linen boiled or steeped in some disinfectant fluid.

3. **Disinfection of a Person.**

A bath-room with a dressing-room on either side is arranged. The person to be disinfected strips in one room and an attendant takes his clothes to the disinfector. He then has a warm bath, and waits in the third room until his disinfected clothes are returned. It is not necessary to add a disinfectant to the bath provided plenty of soap be used.

4. **Disinfection of Utensils.**

This is usually carried out by boiling, or by chemical disinfectants.

5. **Disinfection of Excreta.**

(*a*) **Urine.**—Add to the urine an equal quantity of perchloride of mercury (1–1,000) or carbolic acid (1–20), and allow to stand for at least two hours before being passed down the drain.

(*b*) **Fæces.**—Add a quantity of perchloride of mercury or carbolic acid sufficient to cover the whole stool, and allow to stand for at least two hours before being passed down the drain.

The bed pan while standing must be covered with a towel soaked in the disinfectant.

(*c*) **Sputum.**

(i) The patient spits into an earthenware spittoon which contains some perchloride of mercury

or carbolic acid, and which must be thoroughly cleaned after being emptied.

(ii) The patient spits into a paper spittoon or into a piece of lint or linen rag which is afterwards burnt.

GENERAL TREATMENT OF INFECTIOUS FEVERS.

(1) While the fever lasts the patient is kept in bed and on milk or low diet.

(2) He should be sponged all over every morning and evening.

(3) The medicines generally prescribed are diaphoretics (which cause sweating), and a purgative at the beginning of the illness.

HINTS TO NURSES EMPLOYED IN INFECTIOUS WARDS.

(1) Wash your hands as soon as possible after touching the patient, his clothing or bedding; also after handling the bed pan, urinal, thermometer, &c.

Do not handle the end of the thermometer which has been in the patient's mouth.

(2) Wash your hands carefully before eating your meals.

(3) Never use cups, plates, spoons, knives, forks, &c., which have been used by the patients. Keep your own utensils in a separate place so that you will know that you are always using the same articles.

(4) See that your patients do not mix with the patients from other wards.

(5) On no account may the nurse enter any ward but his own.

(6) On no account may a patient enter the nurse's cabin.

(7) The nurse must never eat his meals with the patients.

Table of Infectious Diseases.

Disease.	Day of Illness on which the Rash appears.	Incubation Period.	Quarantine Period.	Isolation Period.
Chicken pox or Varicella.	1st day.	10 to 16 days.	18 days.	Until all scabs have fallen off (usually 21 days).
Scarlet fever -	2nd day.	1 to 8 days, usually 3 to 5.	10 days.	Until desquamation, sore throat, and albuminuria disappear, but never less than 6 weeks.
Small pox -	3rd day.	12 to 14 days.	16 days.	Until every scab has disappeared (usually from 4 to 6 weeks).
Measles or Morbilli.	4th day.	10 to 14 days.	16 days.	21 days from the appearance of the rash.
Rubella or German measles.	3rd or 4th day.	7 to 18 days.	20 days.	10 days from the appearance of the rash.
Typhus fever -	5th day.	5 to 12 days.	14 days.	4 weeks.
Enteric fever or Typhoid fever.	7th day.	7 to 21 days.	Not observed.	Until the urine and fæces are free from the bacillus typhosus.
Mumps - -	—	10 to 22 days.	24 days.	At least 3 weeks, but 1 week must have elapsed since all swelling of the gland subsided.
Whooping cough or Pertussis.	—	7 to 14 days.	21 days.	5 weeks.
Diphtheria -	—	2 to 10 days.	12 days.	At least 4 weeks, or until there is no nasal discharge, no albuminuria, and no diphtheria bacilli are found in the throat.
Influenza -	—	1 to 6 days.	Not observed.	Not observed.

CHICKEN POX OR VARICELLA.

Incubation Period.—10 to 16 days.
Quarantine Period.—18 days.
Isolation Period.—Until all scabs have fallen off (usually 21 days).

Symptoms.

The rash appears on the first day of the illness and consists of vesicles, which dry and form scabs. The vesicles come out in crops, mostly on the trunk, face and scalp, and only a few on the limbs.

There is usually very slight fever, and the patient does not feel very ill. The vesicles which form on the scalp may be painful and prevent sleep.

Treatment.

On general lines. A dusting powder or alkaline lotion may be applied to the spots.

Complications.

None important. There may be slight pitting of the skin where the scabs have been.

SCARLET FEVER.

Incubation Period.—1 to 8 days, usually 3 to 5.
Quarantine Period.—10 days.
Isolation Period.—Until desquamation, sore throat, and albuminuria disappear, but never less than six weeks.

Symptoms.

These come on suddenly, the most marked being fever and sore throat.

The rash appears on the second day and consists of bright red papules set very close together, which give the skin a scarlet hue. It is seen first on the neck and then spreads to the chest, arms, abdomen and legs. It is usually most marked on the neck, the flanks, the front of the bend of the elbow, and on the inner sides of the thighs and knees, but never appears on the face. It usually lasts about five days.

The throat remains sore for some days. The tonsils are red and swollen and often covered with yellow patches.

The tongue is at first covered with a white fur through which the red papillæ show, giving it the appearance of a strawberry. Later, when the fur disappears, the tongue becomes very red.

The fever is usually high and lasts about a week. It may cause some flushing of the face which must not be mistaken for the rash.

Desquamation, or peeling of the skin, commences as the rash disappears, and is first noticed on those parts of the body where the rash was most marked. It commences as a small white spot, in the centre of which a hole appears. From this centre a circular scale separates. This "*pin-hole*" *peeling* is characteristic of Scarlet Fever. The scales may be small or may come away in large flakes. The last parts to peel are the palms of the hands and the soles of the feet.

Treatment.—On general lines.

For the sore throat, fomentations may be ordered and various gargles, sprays or paints.

When desquamation begins, the patient's skin may be rubbed with oils or simple ointments to prevent the scales floating about, and a daily hot bath given.

Save a specimen of urine for examination each day, or as ordered, and be on the look-out for signs of complications.

The infection is contained chiefly in the secretions from the throat, in the urine, in the peeling skin, and in discharges from the ears.

Complications.

(1) **Hyperpyrexia.**

This must be reported, and is treated by the external application of cold.

(2) **Nephritis**, or Inflammation of the Kidney, is very liable to occur.

For an account of this disease *see* page 358.

(3) **Otitis Media**, or Inflammation of the Middle Ear.

The infection spreads from the throat to the ear by Eustachian Tube.

For an account of this disease *see* page 376.

(4) **Rheumatism.**

For an account of this disease *see* page 340.

(5) **Heart Disease.**

SMALL POX OR VARIOLA.

Incubation Period.—12 to 14 days.

Quarantine Period.—16 days.

Isolation Period.—Until every scab has disappeared (from 4 to 6 weeks).

Symptoms.

The onset is sudden, with a rigor, headache, and pain in the back. The temperature rises to 103° or 104°, and there may be some delirium.

The rash appears on the third day, on the forehead, scalp, forearms, trunk and legs. The papules may also appear on the mucous membrane of the mouth, larynx, and trachea, and on the conjunctivæ. At first the rash consists of papules, which are small and red and feel like shot under the skin. On the 6th day the papules become vesicles, on the 8th pustules, and on the 10th scabs form, which, in time, fall off leaving deep white pitted scars. When the papules appear the temperature falls, but rises again when the pustules are forming.

The patient's skin has usually a very foul odour.

Varieties.—There are four varieties of small pox.

(1) **Modified Small Pox,** where the symptoms are less severe and the amount of rash smaller owing to the patient having been vaccinated.

(2) **Discrete Small Pox,** where the pustules are distinct and do not run together.

(3) **Confluent Small Pox,** where the pustules run together and the symptoms are very severe.

(4) **Malignant Small Pox,** where, in addition to the ordinary symptoms, hæmorrhages occur under the skin, or from the bowels, stomach, lungs, kidneys, or bladder. This variety is fatal in a day or two.

Treatment.

The body must be sponged over twice daily or warm baths given when the patient is strong enough. The

mouth must be kept clean and the eyes washed with boric lotion. The eruption is usually covered with some oily dressing, such as vaseline or carbolic oil, or with cold water compresses covered with protective tissue. A mask is made to cover the face. A cradle may be required to relieve the patient of the weight of the bed-clothes. Feeding may be difficult owing to the condition of the mouth. Delirium is common and the patient must be carefully watched. See that the windows and door are kept closed, as he may attempt to escape and may injure himself by falling.

Complications.

Hyperpyrexia.
Bronchitis and pneumonia.
Ulceration of the cornea, resulting in loss of sight.
Otitis media.
Septicæmia.

VACCINATION.

Cows suffer from a disease called **Cow Pox,** the udders and teats being the parts affected. In 1796 Jenner observed that a person who became infected with the matter from a case of cow pox never got small pox. He inoculated his own son with the cow pox matter taken from the hand of a dairymaid who had been infected, and later he treated other children in the same way. He then inoculated them with matter taken direct from a case of small pox, but the disease did not occur. Thus, the efficiency of vaccination was fully demonstrated.

Method of Vaccination.

Formerly the "arm-to-arm" method was used, whereby the matter from one recently vaccinated child was used to vaccinate others. Now, however, each person is vaccinated with a fresh supply of **calf lymph,** so that there is no danger of infecting him with any disease such as syphilis.

The upper part of the left arm is the site usually selected, and the skin thoroughly cleansed. If any antiseptic is used it must be washed off with sterile water.

The skin is scratched with a vaccinator in four places, and the lymph rubbed in and allowed to dry. Papules, vesicles, pustules and scabs form on these parts as in small pox.

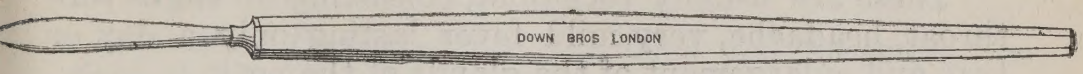


Fig. 174.—Vaccinator.

Vaccination does not necessarily prevent a person getting small pox, but if he does become infected the disease is of a very mild type (modified small pox).

The effect of vaccination disappears after a time, and everyone should be re-vaccinated at least once, but preferably every five or seven years.

MEASLES OR MORBILLI.

Incubation Period.—10 to 14 days.

Quarantine Period.—16 days.

Isolation Period.—21 days from the appearance of the rash.

Symptoms.

The disease commences like a common cold, with sneezing, running at the eyes and nose, headache, cough, and slight fever. On the fourth day *the rash* appears on the face, and then spreads downwards to the neck, chest, abdomen and limbs. It consists of dull red macules which run together forming half-moon patterns, and lasts about three days.

On the mucous membrane of the inner sides of the cheeks may be seen minute bluish-white spots called *Koplik's spots.*

The temperature falls at the end of a week and the symptoms disappear, but the cough may remain for some time.

Treatment.

On general lines. Guard against a chill.

Complications.

Bronchitis, pneumonia, and otitis media.

RUBELLA OR GERMAN MEASLES.

Incubation Period.—7 to 18 days.

Quarantine Period.—20 days.

Isolation Period—10 days from the appearance of the rash.

Symptoms.

These are usually very mild, consisting of slight sore throat, headache, very mild fever lasting only a day or two, and enlargement of the glands of the neck.

The rash appears on the third or fourth day, on the face and chest, spreading to the trunk and limbs. It consists of red papules, larger and duller than in scarlet fever, smaller and brighter than in measles, and lasts about 2 days.

Treatment.

Beyond keeping the patient in the ward for a few days and avoiding a chill, no treatment is usually necessary.

Complications.—None.

TYPHUS FEVER OR JAIL FEVER.

Incubation Period.—5 to 12 days.

Quarantine Period.—14 days.

Isolation Period.—4 weeks.

This disease is now almost unknown owing to improved sanitation. It was a disease which accompanied overcrowding in dirty, badly ventilated houses.

Symptoms.

These come on suddenly with headache, shivering, vomiting, and a rapid rise of temperature to 104° or 105°.

The rash appears on the fifth day on the trunk and limbs but not on the face. It consists of dull red mottling of the skin with small hæmorrhages like flea-bites, and has been called the "*mulberry*" *rash* of typhus. It lasts about two weeks.

Great prostration is a marked symptom, and delirium is common.

The fever ends by crisis about the 13th day.

Treatment.

On general lines. Abundance of fresh air is essential.

Complications.

Bronchitis and diarrhœa.

ENTERIC FEVER OR TYPHOID FEVER.

Incubation Period.—1 to 3 weeks.

Quarantine is not observed.

Isolation Period.—Until the urine and fæces are free from the Bacillus Typhosus.

This important disease is caused by the *Bacillus Typhosus*, or typhoid bacillus, which enters the body through the mouth in infected food or drinks, of which shell-fish, water and milk are the commonest.

The bacilli cause inflammation of Peyer's Glands in the ileum, which become gangrenous. When the resulting slough comes away an ulcer is formed, and hæmorrhage is liable to occur into the intestine. The ulceration may extend through all the coats of the intestine, so that fæces escape into the peritoneal cavity. These important facts must be borne in mind when dealing with a case of enteric fever.

Symptoms.

These come on very gradually with loss of appetite, general indisposition, and headache. There may also be some cough, diarrhœa, and bleeding from the nose.

At the end of the first week the temperature will be about 103° or 104°; the skin hot and dry; the tongue furred, except at the sides and tip which are clean; the abdomen distended; and there may be either diarrhœa or constipation. If diarrhœa is present the stools are liquid and yellowish-brown in colour, and are called the "*pea-soup*" *stools* of enteric fever. The spleen becomes enlarged.

The rash appears about the 7th day, on the abdomen, back, and lower part of the chest. It consists of fairly large, raised, rose-pink spots, which fade on pressure. They are usually few in number and come out in crops. Each spot lasts about 4 days and the rash lasts about 14 days.

Later, the patient becomes very weak; he loses flesh; his cheeks are slightly flushed; he is drowsy and incapable of any exertion. He suffers from thirst, and, unless carefully attended to, his lips and teeth become

covered with *sordes*. His tongue is dry, dirty, and often cracked. Delirium is common.

In simple cases the fever lasts about 3 weeks. During the first week the temperature rises by steps, followed by continued fever; during the second week the fever is continued or remittent; and during the third it ends by lysis.

As the temperature falls the appetite improves, but convalescence is very slow.

It will be noticed that enteric fever is practically a painless disease after the initial headache has passed off.

Death seldom results from the effects of the fever itself, but is due to one or other of the complications which are so apt to occur.

Complications.

In the 1st week	-	Hyperpyrexia; Delirium; Exhaustion.
In the 2nd week	-	Pneumonia; Bronchitis; Pleurisy.
In the 3rd week	-	Hæmorrhage; Perforation.
Later - -	-	Relapse; Thrombosis.
At any time -	-	Bed-sores.

Treatment of Enteric Fever.

The patient is more easily nursed on an ordinary bed, but a water-bed is used if there is a special tendency to bed-sores. A draw-sheet is essential.

The body must be sponged all over night and morning, special attention being paid to the lower part of the back and the buttocks. After thorough washing, these parts are rubbed with methylated spirit and a dusting powder used.

The mouth, tongue and teeth must be frequently cleaned to prevent the formation of sordes and to keep the tongue soft. The patient must not be allowed to exert himself. At least two attendants must be present to turn him or alter his position in bed; the bed-pan or urinal must be placed in position for him; he must be handed the feeding cup, and not allowed to reach for anything off the bedside table,

All excreta and soiled linen must be at once removed and disinfected. The nurse is liable to become infected, and the greatest care must be taken in washing the hands after touching the patient, the bed, the clothing, or any utensil.

Feeding.

This is the most important part of the treatment. The base of a Typhoid ulcer is often no thicker than the epidermis over a blister, and any solid food passing down the intestine might tear this, causing a perforation, followed in nearly every case by death.

From the time Enteric Fever is suspected, no solid food must be given until the temperature has been normal for at least 10 days.

Milk is the chief food and must be looked upon as *a food* and *not a drink.* About 3 pints are given in 24 hours. The feeds are given *regularly* every two hours, and consist of 5 ounces of milk diluted with 3 ounces of water, barley water, or lime water. Peptonised milk, whey, or albumen water are used when ordinary milk does not agree with the patient.

For the thirst, freshly-made lemonade, barley water or cold water are given.

Other food may be ordered by the Medical Officer, such as egg-flip, jellies, custard, junket, or Benger's Food, and beef tea if the diarrhœa is not excessive.

When the patient is convalescent, he is allowed boiled bread and milk, thin bread and butter, eggs (poached or boiled); then fish, mince, chicken, chops, &c. will lead him back to full diet.

The patient's friends frequently attempt to smuggle food into Hospital for him, under the mistaken idea that he is being starved. The nurse must be on the lookout for this and report any such attempt to the Medical Officer.

Drugs are of little use. Calomel and certain antiseptics, such as Salol may be ordered. If these are sent to the ward in the form of tablets they must be crushed to a fine powder before being administered.

Treatment of Special Symptoms.

Diarrhœa.—If excessive, a starch and opium enema may be ordered. In such a case do not tire the patient by frequently lifting him to place the slipper, but let him pass his motions on to pads of tow or cotton wool.

Constipation is fairly common, and for its relief a simple enema is usually ordered every other day.

Convalescence is very slow. When strong enough, the patient is first allowed to sit up in bed supported by a bed-rest. He may next be allowed to lie on a couch, then sit up in an armchair, and finally take short walks in the ward. There is always a danger of straining his heart by too early or prolonged exercise, and it takes some time before his muscles recover their tone.

Signs and Treatment of the Complications.

1. Hyperpyrexia.

Although this has been stated to mean any temperature over 105°, the treatment for it is often carried out in Enteric Fever long before this mark is reached. The Medical Officer will give orders that the temperature is to be reduced whenever it reaches a certain height, possibly 103° or 104°.

Treatment.

The only satisfactory treatment is by the external application of cold (*see* page 257). Cold and tepid sponging are the commonest methods.

2. Delirium and Exhaustion.

These usually occur together, and may be due to want of sleep.

Treatment.

A cold or tepid sponge at night with a change of bed- and body-linen may produce sleep and relieve these symptoms.

Stimulants, of which brandy, strychnine, and digitalis are the chief, may be ordered.

3. Pneumonia and Pleurisy.

These diseases are serious complications and a frequent cause of death. They are treated as when occurring alone.

4. Hæmorrhage.

This may be caused by a vessel being torn when a slough separates, or by the ulceration directly attacking a vessel. It usually occurs between the 14th and the 24th days of the disease.

Symptoms.

The symptoms are those of internal hæmorrhage—a rapid fall in temperature being usually a very marked sign. The blood which escapes from the rectum is usually dark red in colour, and may be liquid or in clots. The quantity varies from a few drops to a pint or more at a time.

Treatment.

Report the occurrence at once.

Report a rapid fall in temperature even if there is no other sign.

Stop all food, drink, and medicine.

Apply ice to the abdomen and warmth to the extremities.

Prepare a hypodermic syringe and have Morphia at hand.

These may all be done by the nurse without waiting for orders.

5. Perforation.

This is generally due to ulceration of the peritoneal coat of the intestine. The perforation is usually very small, but fæces nevertheless escape into the peritoneal cavity and cause Peritonitis. This complication is almost invariably fatal.

Symptoms.

The symptoms are those of Shock. The patient may complain of sudden pain in the abdomen, which becomes distended and does not move on respiration. There is a rapid fall in temperature.

Treatment.

Follow the rules given under hæmorrhage.

In these cases an operation is performed, if the patient be fit enough, and the perforation closed by sutures.

6. **Relapse.**

This is probably due to the poison produced by another generation of bacilli, but in a few cases the cause is improper feeding, A patient may have two, three, or more relapses.

They generally occur about 10 days after the original fever ends.

Symptoms.

The original symptoms recur, but are milder and last a shorter time.

Treatment.

The feeding and general management are carried out as for the original attack.

7. **Thrombosis.**

This usually occurs in the femoral vein during the early days of convalescence.

Symptoms and Treatment.

See page 346.

8. **Bed-sores.**

These are particularly liable to occur. The patient is confined to bed for a long time; he is too ill to change his position in bed; his skin is apt to get wet and soiled by urine and fæces.

Treatment.

See page 110.

To decide whether a patient is suffering from enteric fever or not, a test called the *Widal Reaction* is applied to the blood.

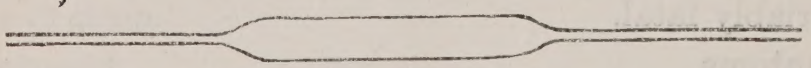


Fig. 175.—Widal Tube.

MUMPS.

This is an infectious disease characterised by swelling of one or more of the salivary glands—usually the parotid.

Incubation Period.—10 to 22 days.

Quarantine Period.—24 days.

Isolation Period.—At least three weeks, but one week must have elapsed since all swelling of the gland subsided.

Symptoms.

The patient complains of pain and stiffness on moving the lower jaw, and there will be swelling of one or more of the salivary glands. His temperature is raised, often to 104°. The fever lasts about a week and the swelling about 10 days.

Treatment.

On general lines.

As the infection spreads by the salivary ducts to the mouth, an antiseptic mouth wash must be used frequently. For the pain, hot fomentations are applied. The patient is usually kept in bed for at least 10 days.

Complication.

Orchitis, or inflammation of the testicle, is very liable to occur at the end of the first week. The temperature rapidly rises, and the testicle is found to be painful, tender, and swollen. This condition does not usually last more than a week.

Treatment.

The testicle is raised on a splint or by a suspensory bandage, and fomentations applied.

WHOOPING COUGH OR PERTUSSIS.

This disease is very common among children, but adults occasionally suffer.

Incubation Period.—7 to 14 days.

Quarantine Period.—21 days.

Isolation Period.—5 weeks.

Symptoms.

The disease commences like a common cold. After a week or two the peculiar "*whoop*" is heard in the cough. This occurs on *inspiration* and follows a series of short expiratory coughs. It may thus be distinguished from a dry "brassy" cough where the whoop occurs during *expiration.*

Treatment.

This may be summed up in the terms: rest, warmth, fresh air and tonics.

DIPHTHERIA.

This is an infectious disease characterised by the formation of a membrane on some mucous surface—usually on the tonsils and soft palate.

It is caused by the *Diphtheria Bacillus.* All secretions from the nose and mouth are infectious.

Incubation Period.—2 to 10 days.

Quarantine Period.—12 days.

Isolation Period.—At least four weeks, or until there is no nasal discharge, no albuminuria, and no bacilli are found in the throat.

Symptoms.

These come on gradually, with general indisposition, sore throat, and moderate fever. Then a creamy-white deposit forms on the tonsils, and spreads to the uvula and soft palate. This membrane may form on other parts, such as the larynx, trachea, nostrils, conjunctiva or on an open wound. The glands in the neighbourhood are enlarged, and serious complications are liable to occur. The fever lasts for one or two weeks.

The great danger is of asphyxia due to obstruction of the larynx or trachea, which frequently occurs in children.

Treatment.

Various antiseptic gargles, sprays, and lotions are used for the throat; but the chief treatment consists in injecting into the body a substance called *Diphtheria Antitoxin.* This is prepared from the blood of a horse which has been inoculated with increasing doses of the toxins produced by the diphtheria bacillus. The antitoxin is injected, with a large metal or glass syringe, into the flank or between the scapulæ, the skin having been previously cleaned with ether soap and water, or it is given by the rectum.

The attendant may become infected by the patient coughing in his face. To prevent infection in such a case, the attendant should at once wash his mouth out with some antiseptic, bathe the eyes with boric lotion, and inform the Medical Officer.

Complications.

Pneumonia, heart failure, nephritis, paralysis of various muscles—most commonly the soft palate.

INFLUENZA.

This disease is said to be due to a definite germ—the Influenza Bacillus.

Incubation Period.—1 to 6 days.

Quarantine and *Isolation* are not observed.

Symptoms.

The onset is fairly sudden, with fever and the signs of a bad cold; but the patient feels much more ill than with ordinary catarrh, and has severe pains in the back, limbs, and head. In some forms the lungs are mostly affected, and pneumonia or bronchitis may complicate the disease; in others, the heart may suffer, causing palpitation and dyspnœa; while in others, again, diarrhœa and vomiting may be the chief symptoms.

The acute illness lasts about a week, but convalescence may be very prolonged.

Treatment.

On general lines.

MALTA FEVER OR MEDITERRANEAN FEVER.

This is a long-continued fever which may last for a year or more, and is caused by a definite germ—the *Micrococcus Melitensis.* It occurs chiefly in the countries around the Mediterranean Sea. Since it has been discovered that infection is spread by goat's milk, the disease is dying out among Europeans.

Symptoms.

The patient suffers from fever which lasts for a week or two; then the temperature remains normal for about a week, after which the fever returns, and so on through the whole course of the illness. He becomes pale and very weak, and the joints may become painful and swollen.

Treatment.

On general lines.

MALARIA OR AGUE.

This is a recurrent fever caused by the *Malarial Parasite* which is carried by mosquitoes, and enters the blood when the insects bite.

It is infectious only in that a person, whose blood contains the parasites, may be bitten by a mosquito which will later on bite another person, and so introduce the parasite into his blood. It occurs mostly in sub-tropical countries, and only where a certain form of mosquito is found. Low-lying, marshy land is especially dangerous, as this forms an excellent breeding ground for the mosquito.

Symptoms.

The disease consists in attacks of fever which recur at regular intervals. Each attack may be divided into three stages :—

(1) **The Cold Stage.**—The patient shivers and feels cold, but his temperature is rapidly rising. He goes to bed, and covers himself with extra blankets. This stage lasts about half-an-hour.

(2) **The Hot Stage.**—He begins to feel warm, and removes most of the bed-clothes. The skin feels hot and dry, and he suffers from severe headache. The temperature will now be 105° or higher. This stage lasts three or four hours.

(3) **The Sweating Stage.**—During this stage the patient perspires freely, the headache and thirst disappear, and the temperature returns to normal. This stage lasts about two hours.

These attacks occur every day, every other day, or every third day, according to the form of malarial parasite, and each lasts about six hours.

Treatment.

During the attack, treat on general lines.

The only drug which has any effect is quinine, which is given by the mouth, by the rectum, or by intra-muscular injection.

Prevention.

The mosquito bites only at night; therefore, in malarial countries, return indoors before sunset.

Always sleep in a mosquito net.

A weekly dose of quinine tends to prevent infection.

CHOLERA.

This disease is caused by the "*comma*" *bacillus*. It causes several hundreds of thousands of deaths yearly in India and Russia, and cases have occurred in almost every country. Infection generally occurs through drinking water or eating uncooked vegetables which have been contaminated with the fæces of a cholera patient.

Symptoms.

These commence with pain in the abdomen, diarrhœa and fever. In a short time the stools become pale and watery and contain little white masses like rice, hence the common term the "*rice-water*" *stools* of Cholera. The skin is cold and clammy, the patient vomits, suffers from cramp in the muscles of the abdomen, and becomes collapsed. 50 per cent. of the patients die.

Treatment.

Keep the patient warm. Stimulants and the infusion of normal saline solution may be ordered.

Prevention.

In countries where Cholera is prevalent, never drink any water which has not been boiled, and never eat any uncooked vegetables. The stools of a patient must be carefully disinfected.

DYSENTERY.

This disease is due to various organisms which cause inflammation and ulceration of the large intestine. It is commonest in China, India, and Africa. Epidemics are liable to occur where crowds of people collect, as in an army. Infection is carried by polluted water.

Symptoms.

These are profuse diarrhœa, the passage of blood and mucus from the bowel, slight fever, and great prostration. The bowels may be opened from 10 to 60 times

a day. The disease is very liable to become chronic in a milder form, and may last for years; or abscess of the liver may occur.

Treatment.

This consists in keeping the patient on milk diet alone, and the administration of large doses of Ipecacuanha or Magnesium Sulphate.

Prevention.—As in Cholera.

Abscess of the Liver.

This is very liable to occur after Dysentery and only one-third of the cases recover.

Symptoms.—Pain over the liver, rigors, fever, and anæmia.

Treatment.—The abscess is opened and drained.

PLAGUE.

This disease is caused by the *Bacillus Pestis*, and is carried by fleas from rats. It occurs chiefly in India and China, but may be carried to any sea-port by the rats in a ship.

Symptoms.

There are two chief varieties of the disease—Bubonic and Pneumonic Plague.

In the former, the formation of buboes is the chief sign; in the latter, a rapidly fatal form of Broncho-pneumonia.

In addition, there is high fever, with rigors, headache, delirium, and great prostration.

The disease is usually fatal in 2 to 5 days, the mortality being from 50–95 per cent.

Treatment.

The symptoms alone can be treated—cold sponging, stimulants, and opening and dressing the buboes.

Large doses of Perchloride of Mercury have been tried internally.

Prevention.

Attempts are made to kill the rats, and the holds of all ships coming from plague-stricken countries are

disinfected with sulphurous acid gas, which kills both the rats and the fleas.

YELLOW FEVER.

This disease occurs in the West Indies, in America, and on the West Coast of Africa. The germ which causes it has not yet been found, but the disease is undoubtedly carried by a certain mosquito.

Symptoms.

The onset is sudden, with high fever which lasts 3 or 4 days. The temperature then remains normal for a few days, when it again rises. The patient's skin is yellow, due to jaundice; he may vomit bile and blood, the so-called "*black vomit*"; and there is albumen in his urine.

Treatment.—A milk diet, and treatment for the internal hæmorrhage.

DENGUE.

This is a very infectious disease, most commonly met with in India, America, and Africa. Its cause is not known.

Symptoms.

These commence suddenly with high fever, headache, and a rash like Scarlet Fever. In about 4 days the fever ends by crisis; but after an interval of 2 or 3 days the fever returns in a milder form. During this second rise of temperature a rash, like Measles, appears.

The most marked symptom, however, is a very severe aching pain in the joints—hence the common name "*Break-bone Fever.*"

The whole attack lasts about a week.

Treatment.—On general lines.

Chapter XIII.

DISEASES OF THE RESPIRATORY SYSTEM.

CATARRH.

This term is used as a convenient name for what is commonly called "a cold in the head." There is usually some fever, which may necessitate the patient being kept in bed for a few days.

PNEUMONIA.

Inflammation of the lungs occurs in two forms—Lobar Pneumonia and Broncho-pneumonia.

ACUTE LOBAR PNEUMONIA.

This is caused by a definite germ—the *Pneumococcus*. It is most liable to occur after exposure to cold, or may complicate measles, scarlet fever, or enteric fever. It is so called because whole lobes of the lung are affected. They become solid so that air cannot enter. As a rule only one lung is affected, but double pneumonia is not uncommon.

Symptoms.

The onset is sudden, with headache, rigors, and often vomiting. The face is flushed and herpes may appear on the lips. There is pain in the side, rapid respiration, and a short cough. After a few days the sputum is of a peculiar rusty colour—due to the presence of blood. There is *dyspnœa* (= difficulty in breathing), and often delirium. The temperature, which rises to about 103° during the initial rigor, remains high for from seven to nine days, and then comes down suddenly—that is, the fever ends by *crisis*.

Complications.

Any of the following are liable to occur :—

Hyperpyrexia.
Pleurisy.
Empyema.
Gangrene of the lung.
Pericarditis.

Treatment.

Rest in bed, warmth, a slop diet, and fresh air are essential. A jacket made of cotton wool is worn round the chest. Stimulants, such as brandy, strychnine, and digitalis are usually necessary, while the pain is relieved by ice-bags or leeches. If the dyspnœa is very marked inhalations of oxygen are ordered, and extra pillows may be required to prop up the patient.

BRONCHO-PNEUMONIA.

In this form the inflammation occurs in small patches scattered throughout both lungs. It is a common complication of measles, enteric fever, scarlet fever, and influenza; and may follow operations on the mouth or throat.

Symptoms.

The onset is gradual, with increasing fever and cough. The temperature is remittent; the sputum is frothy and may be blood-stained. The fever lasts about three weeks and ends by *lysis*.

Treatment is carried out on the same lines as for Lobar Pneumonia.

BRONCHITIS.

Inflammation of the bronchial tubes is caused by a chill or by the inhalation of irritant gases, and is also a common complication of the infectious fevers.

Symptoms.

The onset is gradual, with a feeling of tightness across the chest, cough, and moderate fever. The sputum is at first scanty, but later it increases in quantity and is more easily coughed up. The disease lasts for a week or two.

Treatment.

Rest in bed, warmth, and expectorant medicines.

PLEURISY.

Inflammation of the pleura may be caused by exposure to cold and wet, or by injury, as in fractured rib. It also occurs in Pneumonia, Phthisis, Rheumatism and the acute fevers.

Symptoms.

The onset is sudden. The patient complains of a stabbing pain in the side, which is worse on taking a deep breath and on coughing. There is a slight rise in temperature.

Treatment.

The affected side is usually strapped, in the same way as described for fractured ribs. Iodine, a mustard leaf, or leeches may be applied to relieve the pain. The patient is kept in bed while the fever lasts.

PLEURISY WITH EFFUSION.

In some cases of pleurisy serum collects in quantity between the layers of the pleura, and, by compressing the lung, may cause dyspnœa. The symptoms are as a rule not well marked and there may be no fever.

This condition is treated by drawing off the fluid with the aspirator.

EMPYEMA.

In this disease there is a collection of pus between the layers of the pleura. It often follows pleurisy with effusion.

Symptoms.

The chief symptom is intermittent fever occurring in a patient who has had pleurisy with effusion, and all doubt is settled by drawing off some pus with an exploring syringe.

Treatment.

As soon as pus is found in the pleura the case is transferred to a surgical ward for operation. The operation consists in removing a piece of rib, cutting through the outer layer of the pleura, and draining the cavity through this opening.

PHTHISIS OR PULMONARY TUBERCULOSIS.

This is the disease commonly called Consumption.

Cause.

It is caused by the inhalation of a definite germ—the *Tubercle Bacillus*. A patient suffering from Phthisis spits in the street or other public place; the sputum

becomes dry and mixed with dust, but the Tubercle Bacilli which it contains remain alive; the dust and bacilli float in the air, and are inhaled by other people. Phthisis must, therefore, be looked upon as an infectious disease.

Everyone who inhales Tubercle Bacilli does not develop Phthisis, because, in healthy people, the white blood cells attack and remove the bacilli. The following conditions favour the growth of the bacilli in the lungs :—

Overcrowding, bad ventilation, absence of sunlight, poor feeding, exposure to cold and wet, alcoholism, and debilitating diseases such as Syphilis.

In addition to inhalation, it seems possible that Phthisis is sometimes caused by the bacilli entering the stomach and intestines, milk being the commonest agent.

Changes in the Lung.

The Tubercle Bacilli usually settle at the apex of the Lung, probably because less air passes in and out of that part. There they cause irritation and inflammation. A small part of the lung becomes solid, and then ulceration takes place, resulting in the formation of a small cavity. This ulceration continues so that the cavity becomes larger, and one may open into another. In the very late stages of the disease almost the whole of one lung may have disappeared, leaving only a thin shell.

The last structures to be affected are the arteries, and these may be seen at a post-mortem examination stretching across a cavity and quite unsupported. Should one of these vessels give way, blood will be poured into the cavity, and in time will be expectorated, the quantity depending chiefly on the size of the artery.

Onset.

Phthisis commences in different ways :—

(1) It may commence like a common cold, with a cough which does not get better.

(2) The first sign may be an attack of Hæmoptysis.

(3) It may follow some acute disease, such as Pneumonia or Pleurisy, the symptoms commencing during convalescence.

Symptoms and Course.

The patient has a cough and is easily tired. He loses flesh, becomes pale, and sweats at night. His temperature rises at night, but is usually normal in the morning. The sputum is yellow, thick, and sticky, and on examination under the microscope numerous Tubercle Bacilli may be found. Sooner or later a little blood is seen in the sputum, or the patient has a severe attack of Hæmoptysis. As the disease progresses the amount of sputum increases, and the patient becomes very thin and feeble. In many cases the voice becomes husky, due to Tuberculosis of the Larynx. Death may be due to hæmorrhage or to general debility.

Treatment.

The following are the principles on which treatment is carried out :—

(1) To build up the patient's strength by suitable food and drugs.
(2) To arrange for a constant and plentiful supply of fresh air.
(3) To treat important symptoms as they occur.
(4) To prevent the disease spreading to others.

1. Fatty foods, such as cream, bacon, &c., are ordered in addition to a liberal diet. Milk is given in as large quantities as possible, while cod liver oil is prescribed as a fat-producer.

2. The Tubercle Bacillus dies when exposed to fresh air and sunlight, and so the patient should breathe fresh air both day and night. This is best obtained by keeping him constantly in the open air, in bed if there is much fever, taking gentle exercise if there is little fever. The bed is protected from rain by an overhanging roof, and from the damp at night by mackintosh sheets.

If it is impossible to keep the patient constantly out of doors, he must live in as large a room as possible, the windows of which must never be closed.

3. The following important symptoms require special treatment :—

(*a*) **Hæmoptysis.** *See* page 125.

(*b*) **Cough** is treated with various expectorant drugs. A very soothing mixture is made by adding a few drops of lemon juice to a teaspoonful of glycerine, to be given when the cough is troublesome.

(*c*) **Night Sweats** may be so profuse as to exhaust the patient. The drug mostly used to prevent these is atropine.

(*d*) **Diarrhœa** often occurs in the later stages, and opium or astringent drugs are ordered.

4. The prevention of the spread of Phthisis is an extremely important matter, and it must never be forgotten that you are dealing with an infectious disease. As stated before, infection is spread by the sputum, and the following rules must be strictly carried out :—

Always disinfect every particle of sputum. To carry out this rule a spit-pot or other receptacle must always be used. *Never allow sputum to become dry.*

Chapter XIV.

DISEASES OF THE DIGESTIVE SYSTEM.

CARIES OF THE TEETH.

Decay, or caries, of the teeth is due to acids, produced by the decomposition of food which collects around and between them. These acids corrode the enamel so that septic organisms reach the softer dentine and cause its destruction.

Treatment consists in cleaning out the cavity and filling it with a metal filling, or in extracting the tooth.

Prevention.

The teeth should be cleaned with a tooth brush every night and morning.

ALVEOLAR ABSCESS or GUMBOIL.

This abscess forms in the gum, and is due to a carious tooth.

Treatment.

The abscess is opened, and the mouth is washed out frequently with some hot antiseptic lotion, such as Potassium Permanganate Lotion. The carious tooth is also treated.

THE TONGUE.

The chief diseases which affect the tongue are Cancer and Syphilis.

Cancer of the Tongue is commonest in old men. It commences as a small, hard, often painful lump at the side of the tongue, and soon becomes an ulcer. The glands of the neck are enlarged. The only treatment is removal of the whole or half of the tongue.

Syphilis causes ulcers which are described on page 383.

THE TONSILS.

There are three forms of Inflammation of the Tonsils.

(1) SIMPLE TONSILLITIS.

This often accompanies a "bad cold," and is common where ventilation is imperfect. The patient complains of a sore throat, and the tonsils are swollen and red.

Treatment.

A few days in bed, a purgative, and a gargle soon cure this condition.

(2) FOLLICULAR TONSILLITIS.

In this form small beads of yellow pus are seen dotted over the surface of the red and swollen tonsils. The throat is very sore and the temperature is high.

Treatment.

In addition to the treatment mentioned above the tonsils are painted or swabbed with some antiseptic. Fomentations round the throat ease the pain.

(3) QUINSY.

This is an abscess of the tonsil. Swallowing is difficult and painful and there may be high fever.

Treatment.

The abscess is opened with a scalpel, the blade of which is covered with strapping leaving only about $\frac{1}{2}$ inch bare at the point.

THE ŒSOPHAGUS.

Foreign Bodies, such as pieces of bone, false teeth, &c. may become fixed in the œsophagus, and, if not removed by the method described under **Choking,** must be removed by operation.

Stricture of the Œsophagus may follow corrosive poisoning, Syphilis, or Cancer. The patient has difficulty in swallowing, and in time the œsophagus may be entirely obstructed.

Treatment is usually by operation. An opening is made into the stomach through the abdominal wall, and the patient is fed by a tube passed through this opening.

THE STOMACH.

ACUTE GASTRITIS.

Cause.

Acute inflammation of the stomach may be brought on by errors in diet—eating too hot, too rich, or too much food, or bolting the food without chewing it; by the excessive use of alcohol; and by the irritant poisons, chiefly arsenic, mercury, and ptomaines.

Symptoms.

The onset is sudden, with nausea, vomiting, and retching. The skin is pale and beaded with cold sweat. The patient complains of headache, giddiness, and pain in the pit of the stomach.

Treatment.

First get rid of the irritant by means of an emetic, and then rest the stomach by giving no food for several hours. The first food taken must be such as can be easily digested, and a return to full diet is made gradually.

DYSPEPSIA OR INDIGESTION.

This is a mild inflammation of the stomach and may be acute or chronic.

Causes.

Like Acute Gastritis it is generally caused by errors in diet, and also by the excessive use of alcohol, tobacco, and tea. Bad teeth are often responsible, as the food cannot be properly chewed and is bolted whole.

Chronic Dyspepsia is often the first sign of Cancer or Ulcer of the Stomach.

Symptoms.

These are similar to those mentioned under Acute Gastritis, but are less severe. The pain comes on about half an hour after food, is relieved by vomiting, and is often felt between the shoulders. Constipation and a dirty tongue are also generally present.

Treatment.

The teeth must be attended to, the bowels kept open, and smoking and drinking stopped. The food must be

easily digestable, taken in small quantities, and eaten slowly.

GASTRIC ULCER.

Ulceration of the stomach occurs in anæmic people who work in badly ventilated rooms and are poorly fed.

Symptoms.

The patient suffers from Chronic Dyspepsia and then has an attack of Hæmatemesis. Some of the blood passes into the intestines, and after a time escapes from the rectum as a thick, black, tarry-looking mass. This altered blood is called *Melæna*. Pain occurs whenever food enters the stomach and is relieved by vomiting.

This is a serious disease, as death may occur from hæmorrhage or from perforation. The ulceration destroys all the coats of the stomach and food escapes into the peritoneal cavity, causing Peritonitis.

Treatment.

The patient is kept in bed. In mild cases the diet consists of peptonised milk, but in the more severe cases the patient is fed by nutrient enemata.

The treatment of Hæmatemesis is given on page 125.

If perforation occurs, an operation is at once performed. The hole in the stomach is stitched up and the peritoneal cavity washed out.

CANCER OF THE STOMACH.

This disease occurs in middle-aged or old men, and usually attacks the pyloric end of the stomach.

Symptoms.

It commences as a Chronic Dyspepsia, and the patient rapidly loses flesh. There is occasional Hæmatemesis. Later, vomiting is a marked symptom and is due to the food being unable to pass through the diseased pylorus.

Treatment.

Operation is the only hope. The growth may be removed, or an opening is made from the stomach into the jejunum, so that the food passes into the intestines without going through the pylorus.

VOMITING.

This is the forcible expulsion of the contents of the stomach through the œsophagus.

Causes.

(1) Irritation of the Fauces and the action of Emetics.
(2) Most diseases of the Stomach.
(3) Diseases of the Liver, Intestines and Kidneys; especially Cirrhosis of the Liver, Strangulated Hernia, and Acute Nephritis.
(4) Severe Injuries, such as a blow on the testicle, a dislocation, or a crush.
(5) Injury and Disease of the Brain.
(6) Any disgusting sight, smell or taste.
(7) At the commencement of an Acute Illness, such as Pneumonia or Scarlet Fever.
(8) Sea Sickness.

THE INTESTINES.

ENTERITIS or simple inflammation of the intestines is generally accompanied by, and is due to the same causes as, Acute Gastritis. The symptoms are those of Acute Gastritis together with Diarrhœa.

ENTERIC FEVER is the most important disease of the intestines and is described under Infectious Diseases.

INTESTINAL OBSTRUCTION.

Causes.

(1) **Strangulation.**—A band of fibrous tissue may form in the abdomen as the result of inflammation, and a loop of intestines slip under it and become constricted.
(2) **Volvulus.**—In this condition the intestine is twisted.
(3) **Intussusception.**—Part of the ileum may be forced through the ileo-cœcal valve into the cœcum.
(4) **Strangulated Hernia.**

Symptoms.

Owing to the obstruction, no fæces or flatus are passed. The patient complains of acute pain in the

abdomen, and vomiting soon occurs. The vomit at first consists of food and bile, but later smells strongly of fæces. The abdomen becomes distended, the pulse rapid and feeble, and the patient collapsed.

Treatment.

An operation is *at once* performed. The constriction or obstruction is removed, and any part of the intestine which may be gangrenous is excised and the cut ends united.

APPENDICITIS.

Cause.

Inflammation of the vermiform appendix is generally due to constipation. A small piece of hard fæces gets into the appendix and causes irritation. Other causes are undigested food, fruit stones, a toothbrush bristle, &c., which act in the same way.

Symptoms.

The onset is fairly sudden, with acute abdominal pain. There is a tender spot about midway between the umbilicus and the *right* anterior superior spine of the ilium, and this tenderness may cause the patient to lie with the knees drawn up. The temperature is raised to about 103°, the pulse is rapid, and there is constipation and vomiting.

The disease may end in recovery, or in the formation of an abscess.

In the latter case a distinct swelling forms in the right side of the abdomen, while, in favourable cases, the pain and fever disappear in a few days.

People who have had one attack are very liable to have others.

Treatment.

The patient must be kept absolutely at rest in bed, and on milk diet. Hot fomentations to relieve the pain, and an enema may be ordered.

If the patient's condition becomes worse, or an abscess forms, an operation is performed, and the appendix

removed, or the abscess drained. In other cases the appendix is removed after the acute attack, when the patient is well, to prevent a recurrence.

HÆMORRHOIDS OR PILES.

These consist of dilated veins at the lower end of the rectum, and may be entirely within the anus (*internal piles*), or partly outside (*external piles*).

Causes:—

(1) Any obstruction to the free flow of blood through the portal vein, such as cirrhosis of the liver (due to alcohol), or heart disease.

(2) Constipation.

(3) Cancer of the Rectum.

Symptoms.

Piles appear as small purple swellings protruding from the rectum. They cause pain when the bowels are opened, and the stools may be streaked with bright red blood. Sometimes severe hæmorrhage occurs, and the patient in time becomes very anæmic. If the pile becomes inflamed, or strangulated by the muscle surrounding the anus, there is severe pain.

Treatment.

The bowels are kept open by daily doses of confection of senna, or of sulphur; the piles are kept clean by washing; alcohol and all rich or spiced foods are forbidden. Unguentum Gallæ cum Opio is applied to the part.

If the pile becomes inflamed or strangulated, rest in bed, and hot baths are ordered.

When severe hæmorrhage is frequent, the piles are removed by operation.

ISCHIO-RECTAL ABSCESS.

This is an abscess which forms at the side of the anus, between the rectum and the ischium. The ordinary **signs** of an abscess are present, and the **treatment** consists in opening, scraping, and packing the cavity.

FISTULA IN ANO.

This is a narrow track leading from the rectum to the skin near the anus, and frequently follows an ischio-rectal abscess.

Symptoms.

There is a thin discharge of pus and sometimes of fæces from the external opening, and the patient becomes very depressed.

Treatment.

The fistula is slit up, scraped, and packed with gauze.

CANCER OF THE RECTUM.

This occurs in old men. The patient loses flesh, and has difficulty in passing his motions, which are streaked with blood and slime.

Treatment.

If the case is discovered early, the growth and part of the rectum are removed. If removal is considered impossible, an artificial anus is formed by bringing part of the colon through an opening in the front of the abdomen, and opening the gut. This operation is called *Colotomy*, and its performance allows the fæces to escape freely. A pad of wool, or tow, is kept over the opening, and must be frequently changed, as fæces escape continually, and not at will.

HERNIA.

A hernia, or rupture, is the protrusion of gut from the abdominal cavity. There are several weak spots in the abdominal wall, and, as the result of straining or great exertion, a knuckle of gut escapes through one of these places, and forms a rounded swelling under the skin. At first the swelling is quite small, but gradually becomes larger, and may contain several feet of intestine.

Varieties.

There are four kinds of hernia, according to the position of the swelling :—

(1) Inguinal Hernia.

This is the commonest form in men. The gut escapes through the canal made for the sper-

matic cord, which runs from the testicle to the base of the bladder. The swelling appears at the inner side of the groin, and in old cases the gut passes down into the scrotum.

(2) Femoral Hernia.

This is the commonest form in women. The gut escapes through the opening made for the femoral vein.

(3) Umbilical Hernia.

In this form the gut escapes at the umbilicus, and forms an irregular rounded swelling.

(4) Hernia through a Scar.

This is liable to occur after an abdominal operation, such as for appendicitis. The abdominal wall is weakened, and a bulging swelling occurs.

Herniæ may also be classed as follows :—

(1) Reducible Hernia is one in which the gut can be pressed back into the abdomen.

(2) Irreducible Hernia is one in which the gut cannot be pressed back into the abdomen.

(3) Strangulated Hernia is one which has become nipped by the opening through which it passes.

Symptoms.

Often the hernia gives rise to no symptoms, and, even when large, there is only the discomfort caused by the size of the swelling.

All herniæ are liable to become strangulated. The constriction shuts off the blood supply, and so may cause gangrene of a piece of the intestine, while the passage of fæces is absolutely prevented. The symptoms are those mentioned under Intestinal Obstruction.

Treatment.

A small reducible hernia may be treated with a *truss* which consists of a leather-covered pad kept in place over the opening through which the gut escapes by a leather-covered steel band, which passes round the waist. Trusses are made in different sizes, for either side of the body, and may be single or double.

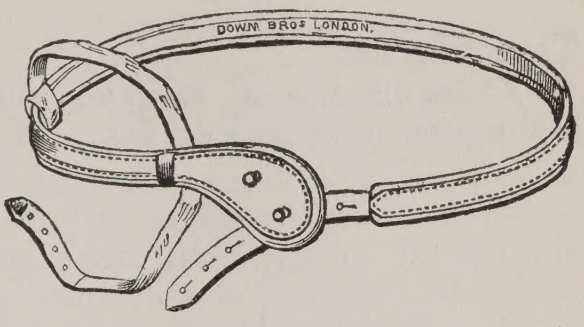


Fig. 176.
Truss for right Inguinal Hernia.

Rules to be observed by a patient wearing a truss:—

(1) The truss must be put on *before* getting out of bed in the mornings.

(2) It may be removed *after* getting into bed at night.

(3) If the patient has a cough it must also be worn in bed.

(4) The hernia must be gently pressed back into the abdomen before applying the truss.

(5) If the hernia will not go back the patient must stay in bed, must not attempt to put on the truss, and must send for medical assistance.

(6) If the hernia escapes past the truss it must be pressed back, and the truss reapplied.

An Irreducible Hernia is operated on as it is a source of danger. The operation consists in closing the opening after returning the intestine to the abdomen.

A Strangulated Hernia is operated on *immediately*. The constricting ring is divided, the intestine returned and the opening closed.

INTESTINAL WORMS.

There are three common varieties of worms which live in the intestines: tape worms, round worms, and thread worms.

Tape Worms.

There are several varieties, and they enter the body in diseased beef, pork or fish. They are flat, from 10 to

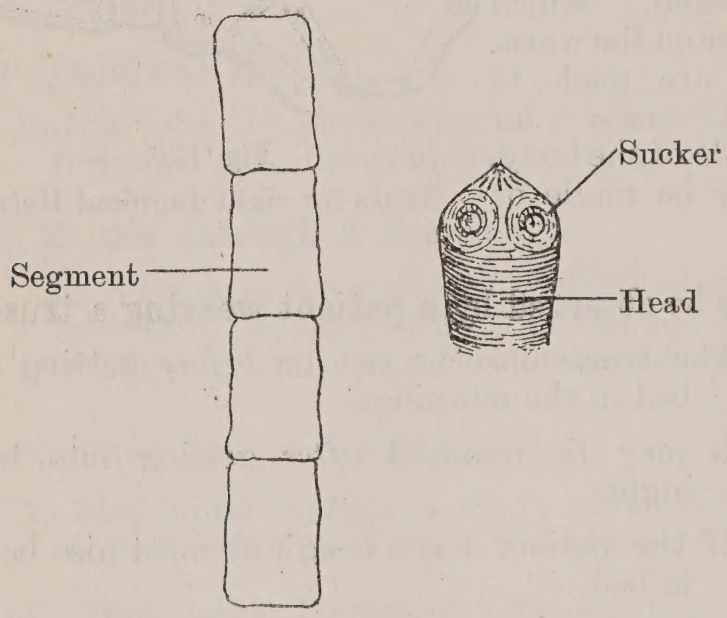


Fig. 177.
Tape Worm.

25 feet in length, and are made up of from 800 to 3,000 segments, with a rounded head at one end.

Round Worms.

These are from 6 to 12 inches in length and resemble the common earthworm.

Thread Worms.

These are from $\frac{1}{6}$ to $\frac{1}{2}$ inch in length and look like small pieces of thread.

Symptoms.

The symptoms to which worms give rise are itching of the anus or nose, dyspepsia, diarrhœa, hunger and

wasting, and, in children, convulsions. The worms, or parts of them, are found in the fæces.

Treatment.

Tape Worms.

The patient is kept on low diet for a few days and the bowels are well opened by purgatives. He then has no food after 6 o'clock one night, and in the morning is given a dose of Liquid Extract of Male Fern, followed in three hours by castor oil. The worm will be expelled and a search is made for the head, because if it remains in the intestine the worm will grow again. To facilitate this search the patient must use a bed pan and not the w.c. This treatment may have to be repeated.

Round Worms.

Santonin is given in 5 grain doses.

Thread Worms.

Rectal injections of quassia or common salt kill these worms.

COLIC.

This term is applied to severe griping pains which come and go.

Intestinal Colic is caused by irritants in the intestines, such as undigested food, ptomaines, alcohol, and lead. It is usually treated by ordering a dose of castor oil and opium.

Renal Colic is caused by the passage of a stone through the ureter, and

Biliary Colic by the passage of a stone through the bile duct from the gall bladder.

For these conditions opium and hot fomentations are usually ordered.

DIARRHŒA.

By diarrhœa is meant a frequent discharge of liquid fæces. It is caused by :—

(1) **Irritants,** such as undigested food, irritant poisons, purgative medicines, intestinal worms, and hard fæces.

(2) **Diseases,** such as enteric fever, cholera, and dysentery.

Treatment.

If due to irritants a purgative may be ordered, or some astringent drug, like opium, bismuth, chlorodyne, lead, catechu, &c. The treatment of diarrhœa due to disease is given under that disease.

THE LIVER.

JAUNDICE.

This is a term applied to the yellow colouration of the skin and other tissues due to bile being absorbed by the blood, instead of passing into the intestine. It affects the white of the eye first and then the skin generally. Bile is found in the urine, which is greenish in colour.

Causes.

(1) Inflammation of the bile ducts. This is the commonest cause.

(2) Obstruction of the bile duct by gall stones or intestinal worms.

(3) Cirrhosis of the liver.

(4) Yellow fever.

Symptoms.

There may be slight fever or the temperature may be sub-normal. There is nausea, loss of appetite, and constipation. The stools are pale and resemble putty, and the urine contains bile. The pulse is very slow, possibly only 40 to the minute. The yellow colour of the eyes and skin lasts about three weeks.

Treatment.

Saline purgatives, such as magnesium sulphate, and low diet are ordered.

CIRRHOSIS OF THE LIVER.

As the result of the excessive use of alcohol, fibrous tissue forms around the liver cells, interfering with their function and causing a general enlargement of the organ. In the later stages, however, the liver becomes much smaller than normal.

Symptoms.

These come on very gradually. There is jaundice, dyspepsia, morning vomiting, and general loss of health. Later, *ascites*, or the collection of serous fluid in the peritoneal cavity, occurs.

Treatment.

Little can be done except in the early stages, when all alcohol is forbidden. When ascites occurs, the fluid is drawn off by means of a trocar and canula.

PERITONITIS.

Inflammation of the peritoneum may be acute or chronic.

ACUTE PERITONITIS.

Causes.

(1) Infection by germs as the result of injury or operation.
(2) Rupture of an abscess of the appendix or liver.
(3) Perforation of the stomach or intestines.

Symptoms.

There is severe, and, in some cases sudden, pain in the abdomen. The patient suffers from shock and has a peculiar anxious expression. The abdominal walls do not move with respiration; and, to relax the tension, he lies on his back with the knees drawn up. There is some fever, except in cases due to perforation when the temperature is sub-normal.

Treatment.

The treatment is entirely operative.

CHRONIC PERITONITIS.

This may be due to tubercle or cancer. In either, the chief symptoms are pain and tenderness of the abdomen, loss of flesh, hectic fever, and in some cases, ascites.

Treatment.

When due to the tubercle bacillus, the general treatment for phthisis is carried out—fresh air and good feeding.

When due to cancer, operative treatment may be employed.

Chapter XV.

RHEUMATISM AND DISEASES OF THE HEART, BLOOD VESSELS, AND BLOOD.

ACUTE RHEUMATISM or Rheumatic Fever.

This is an acute fever accompanied by painful swellings of the joints.

Cause.

There is every reason to believe that it is due to a definite germ, but this has not yet been proved. It frequently follows exposure to wet and cold, or an attack of scarlet fever.

Symptoms.

These come on fairly suddenly. The patient often complains of sore throat, and his temperature runs up to about 103°, where it remains for some days. He perspires freely, the sweat having a disagreeable, sour odour. The joints most commonly affected are the knees, ankles, shoulders, and wrists. They are hot, swollen, and extremely painful on movement. The disease attacks first one joint and then another, and the whole illness lasts from 2 to 6 weeks.

Complications.

Heart Disease is the commonest and most important.
Hyperpyrexia and **Skin Eruptions** may also occur.

Treatment.

Absolute rest in bed, and milk diet are essential. The affected joints are wrapped in cotton wool, on which may be sprinkled a little laudanum or belladonna, or a compress of lint wrung out in a solution of sodium carbonate is applied.

Internally, sodium salicylate is given.

Nursing.

The patient is placed between blankets, which absorb the sweat better than sheets; and for the same reason he should wear a flannel gown. A cradle is useful to keep the weight of the bed-clothes off the painful joints. Remember that all movements are painful, therefore attend to all the patient's wants—such as handing feeds and drinks, placing the bed pan or urinal, &c. The gown and blankets readily become wet with perspiration, so they must be changed, and the skin sponged and dried, as often as necessary.

ACUTE PERICARDITIS or Inflammation of the Pericardium, may be due to injury or may follow rheumatism, scarlet fever, pyæmia, small-pox, or enteric fever.

Symptoms.

These are not very definite, and consist of rapid breathing, a rapid pulse, and pain over the heart. The only definite signs are discovered with the stethoscope.

The disease lasts for 2 or 3 weeks, but death often occurs earlier.

Treatment.

The patient is kept in bed, and on low diet. Leeches, blisters, or an ice-bag are often applied over the heart, but the general treatment depends upon the cause.

HEART DISEASE.

Under this heading are included several conditions with widely different symptoms, all of which cannot be discussed here. Many of these conditions give rise to no symptoms, and the signs of the disease can only be discovered with the aid of a stethoscope.

Heart diseases may be divided into two groups:—(1) those in which the function, and (2) those in which the structure, of the heart is affected.

1. **Functional Heart Disease** or M.C.F. (*morbus cordis functionalis*).

In this condition the heart may beat too slowly, too quickly, or irregularly, or a beat may be missed occasionally.

Palpitation—the condition in which a person is conscious of the beating of his heart—is another form, when due to the excessive use of tobacco or alcohol.

2. **Organic Heart Disease** or M.C.O. (*morbus cordis organicus*). In this condition there is some definite alteration in the structure of the heart due to disease. The parts most commonly affected are the valves; and those on the left side of the heart are more often diseased than those on the right. This is called **Valvular Disease of the Heart.**

Causes.

Rheumatism is by far the commonest cause. Scarlet fever, syphilis, alcohol and over-strain are less common.

Symptoms.

When a valve is affected, small nodules of fibrous tissue are formed on its edges, and these prevent the valve closing properly. The result is that the blood can flow backwards, and so the whole circulatory system becomes affected. In other cases the valve becomes narrowed, so that the heart has difficulty in forcing the blood through it.

The symptoms therefore vary considerably according to the valve affected and the length of time the disease has lasted, but the following are commonly met with :—

(*a*) Shortness of breath.
(*b*) Œdema.
(*c*) Cyanosis.
(*d*) Palpitation.
(*e*) Pain over the heart.
(*f*) Cough.

Whichever valve is affected there is always extra work to be done by the heart. As in other muscles, this extra work produces thickening of the walls of the heart, and this condition is called **Hypertrophy of the Heart.**

In time the walls lose their tone and tend to stretch. They become thinner and the cavities larger. This is called **Dilatation of the Heart.**

Progress.

Many forms of heart disease cause practically no symptoms, and the patient may live to old age. In others death occurs suddenly and without warning. The commonest history is somewhat as follows :—

Shortness of breath is the first symptom noticed, and the breathlessness increases so that the patient cannot work. He has a cough, his legs and ankles become swollen, and dyspnœa occurs when he lies down. The swelling and dyspnœa increase, so that he has to sleep in a chair or propped up in bed. Pneumonia or nephritis follow, and he dies.

Treatment.

This varies so much in each case that no hard and fast rules can be laid down. Rest, a suitable diet, and regular action of the bowels are necessary. Heart tonics, such as digitalis, are often prescribed.

Nursing.

The patient must avoid sudden exertion, excitement, and shocks. Care should be taken to prevent attacks of dyspepsia through eating unsuitable food or eating too quickly.

In the later stages, when the patient suffers from dyspnœa on lying down, he must be propped up in bed with pillows and a bed rest.

DISEASES OF THE ARTERIES.

ANEURYSM.

In this disease the walls of an artery are weakened at one point; they become thin and stretch, causing a swelling.

Causes.

The commonest cause is syphilis, others being the excessive use of alcohol, and over-strain.

Symptoms.

The arteries oftenest affected are the Aorta, the Innominate, the Subclavian, and the Popliteal. In the latter, a pulsating swelling can be felt at the back of the knee, but in the others the tumour cannot, of course, be felt.

The symptoms are due to pressure of the aneurysm on neighbouring structures, and so vary with the artery affected. Pain, swelling of a limb, dyspnœa, and cough are common; and if the aneurysm press against bone, such as the sternum, the bone becomes absorbed, and the pulsating tumour bulges under the skin. Death usually occurs suddenly from hæmorrhage, due to rupture of the wall of the aneurysm.

Treatment.

Aneurysms of the Subclavian and Popliteal Arteries are sometimes treated by ligature. The artery is tied, so that, even if the aneurysm burst, hæmorrhage would not occur; while the circulation is carried out through smaller vessels.

In aneurysm of other arteries, the cause—Syphilis—is treated with potassium iodide, but death usually occurs.

DISEASES OF THE VEINS.

VARICOSE VEINS.

This is a condition in which the superficial veins—usually of the leg—become dilated and twisted.

Cause.

They occur in people whose work necessitates much standing. They may follow certain diseases of the heart and lungs, and have been caused by the use of tight garters.

Signs.

They appear as coils of distended veins, showing dark purple under the skin, and diminishing in size when the limb is raised. They may be painful.

As the veins become dilated, the valves do not meet, and so are useless; consequently the veins of the lower

part of the leg have to bear the weight of a long column of blood. This causes more dilatation, and so the condition grows worse.

The skin over varicose veins is very liable to become affected with eczema, and, as the result of a trifling

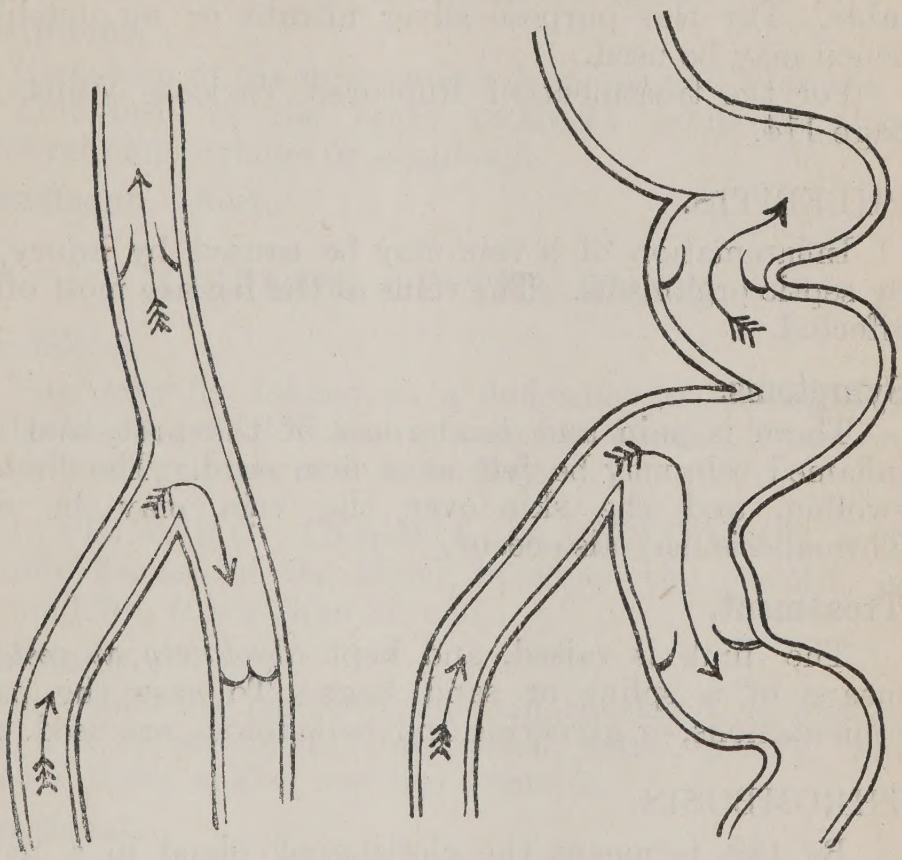


Fig. 178.

Valves in healthy Veins. Valves in Varicose Veins.

injury, an ulcer may form. This ulcer tends to spread, and is very difficult to heal.

Varicose veins are also liable to burst, when serious hæmorrhage results. Owing to the defective valves, blood flows from both ends of the vein, and the heart itself may be drained.

Treatment.

An operation is usually performed. The vein is tied above and below the dilated part, which is removed; or the upper end of the main superficial vein of the leg

is tied, but no part removed. In mild cases, an elastic bandage or stocking is worn.

While preparing the patient for operation, it is usual to mark on the skin the position of the dilated veins, as they may almost disappear when he is lying on the table. For this purpose silver nitrate or an indelible pencil may be used.

For the treatment of Ruptured Varicose Veins, *see* page 114.

PHLEBITIS.

Inflammation of a vein may be caused by injury, or by septic organisms. The veins of the leg are most often affected.

Symptoms.

There is pain and tenderness of the part, and the inflamed vein may be felt as a firm cord. The limb is swollen, and the skin over the vein may be red. Thrombosis may also occur.

Treatment.

The limb is raised, and kept *absolutely at rest* by means of a splint or sand bags. To ease the pain, fomentations, or glycerine and belladonna, are used.

THROMBOSIS.

By this is meant the clotting of blood in a living blood vessel.

Causes.

The commonest causes are:—Injury, ligature, phlebitis, and enteric fever.

Symptoms and Treatment.

These are much the same as in phlebitis.

EMBOLISM.

If a small piece of blood-clot become detached, it is carried by the blood-stream to the heart, and thence to the pulmonary artery or aorta. As arteries diminish in size, the clot will at last reach one through which it

cannot pass. It completely blocks the vessel, and prevents blood flowing to the part supplied by that particular branch of the artery. This usually occurs in the lungs or brain, a small part of which will die. Embolism, then, is the chief danger of thrombosis.

Symptoms.

Embolism of the lung causes dyspnœa and cyanosis.

Embolism of the brain produces symptoms like cerebral hæmorrhage or apoplexy.

Treatment.—Rest.

DISEASES OF THE BLOOD.

ANÆMIA.

This may be defined as a deficiency of hæmoglobin in the blood, or a deficient quantity of blood. There are two kinds—primary and secondary.

1. PRIMARY ANÆMIA OR CHLOROSIS is a definite disease of the blood, in which the quantity of hæmoglobin is less than normal.

Symptoms.

The chief are pallor of the skin, shortness of breath, and loss of strength. Palpitation, fainting fits, and œdema of the ankles, are also common.

Treatment.

Regular action of the bowels, and iron.

2. SECONDARY ANÆMIA is only a symptom, and is due to various causes, the chief of which are:—

Excessive hæmorrhage.

Chronic nephritis.

Chronic lead poisoning.

All wasting diseases—such as cancer and tuberculosis.

Malaria.

Syphilis.

Symptoms.—The same as in chlorosis.

Treatment.—The cause is treated.

HÆMOPHILIA.

This is a disease in which the blood loses its tendency to clot, and so, when a wound occurs, the hæmorrhage cannot be controlled. It is a hereditary disease, and the people who suffer from it are called "*bleeders*."

Symptoms.

After the extraction of a tooth, or as the result of a slight abrasion, capillary hæmorrhage occurs, and may last for days.

Treatment.

Rest, and the application of styptics.

SCURVY.

This disease is due to the absence of fresh meat and vegetables in the diet. It used to be very common among sailors in the days of sailing ships, as fresh food could not be obtained on their long voyages. It is still met with in England among the very poor and underfed.

Symptoms.

These come on gradually, with anæmia and general debility. The gums become swollen and spongy, and bleed readily. Hæmorrhages, often of large size, occur under the skin.

Treatment.

This is almost entirely a question of diet. Plenty of fresh vegetables, fruit, lemon juice, raw meat, and milk are given. A mouth-wash is necessary to harden the gums.

Prevention.

In the Royal Navy, lime juice is issued to the ship's company after being three days on salt provisions.

Chapter XVI.

DISEASES OF THE SKIN.

ECZEMA is an inflammation of the skin accompanied by itching and burning. The skin may be dry and scaly, or there may be a discharge of serum. In the latter case, scabs form which when removed expose a raw surface. The disease may be acute or chronic, and is caused by irritation either on the surface of the skin (as by chemicals) or in the blood.

Treatment.

The cause is treated, and soothing lotions, ointments, or dusting powders applied to the inflamed skin.

Method of applying Ointments.

In treating diseases of the skin, ointments should not as a rule be merely smeared over the part. They should be applied spread on lint, which is fixed with a light bandage. The ointment from the previous application must be carefully wiped off the part before applying a fresh dressing.

ACNE is a disease caused by the blocking of the sebaceous ducts. Dirt collects on the retained sebaceous matter forming what is commonly called a "black head." This causes irritation, and an inflamed papule is formed. The parts mostly affected are the face and the back.

Treatment.

After the sebaceous matter has been squeezed out, an ointment, such as unguentum sulphuris, is applied. Frequent washing with soap and warm water is also necessary.

URTICARIA.—In this disease raised wheals appear on the skin. The part looks as if it had been stung by nettles and consequently the disease is commonly called **"nettle-rash."** It is accompanied by intense itching

and is generally caused by certain foods, especially shell-fish, or by certain drugs, such as copaiba, cubebs, turpentine, iodoform, santonin, quinine, and sodium salicylate.

Treatment.

The cause is treated. If due to irritants in the intestine, a purgative is given; if due to a drug, the medicine containing it is stopped.

HERPES.—This disease is characterised by a crop of vesicles. It occurs mostly around the mouth during a "bad cold" or an attack of pneumonia.

Treatment.

Zinc oxide, methylated spirit, or eau de cologne are applied.

HERPES ZOSTER OR SHINGLES is a painful disease in which vesicles occur on the skin over some nerve. It is most commonly found on one side of the chest or over the eyebrow.

Treatment.

A dusting powder of zinc and starch or zinc ointment is used.

A BOIL is due to inflammation of the skin around a hair follicle. It commences as a red tender papule which soon becomes a pustule. The skin gives way and pus escapes. A slough, called the core, separates in time and the boil then heals.

Treatment.

Hot boric fomentations relieve the pain and aid the escape of pus. A suction bell may be applied. Large painful boils will require incision.

A CARBUNCLE is like a large boil, but there is more sloughing, and pus is discharged from several openings. It is usually accompanied by fever and loss of appetite.

The local treatment is the same as for boils.

PEDICULOSIS.

This is due to a small animal, the *pediculus* or *louse*, which is found among the hairs of the head, pubes, and

axillæ. It resembles a crab in shape and is about the size of a pin-head. The female lays eggs or *nits* which

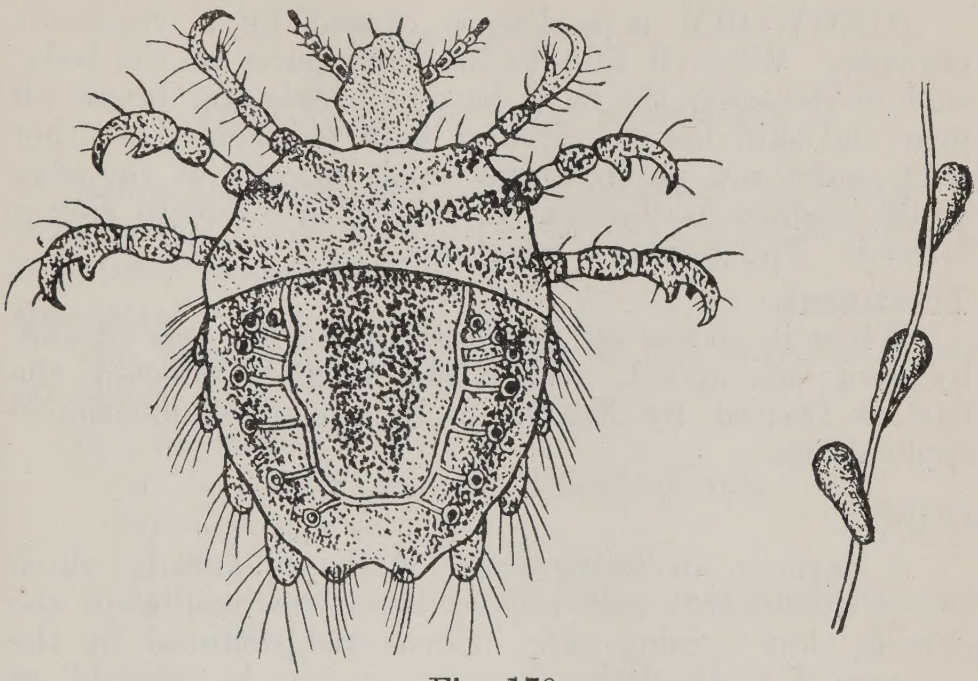


Fig. 179.
Pediculus Pubis and "nits."

are firmly attached to the hairs. The animal causes severe itching and the marks of scratching may be seen.

Treatment.

When it attacks the pubes or axillæ the hair is shaved and ung. hydrargyri rubbed into the skin. When the head is attacked, the hair is cut short.

If possible the clothing should be disinfected as it may contain the lice or nits.

SCABIES OR ITCH.

This disease is due to an animal parasite called an *Acarus*, which is just visible to the naked eye. The female burrows under the skin to lay her eggs, and this causes intense itching. It is found mostly on the lower part of the abdomen, the inner sides of the thighs, the front of the wrists, and between the fingers.

Treatment.

This consists of the daily application of sulphur as an ointment or lotion, after a hot bath. As the disease is

infectious, patients are isolated and their clothes disinfected.

RINGWORM is a disease caused by a vegetable parasite. When it attacks the hairy parts of the body, such as the scalp, the hairs become brittle and break off near the skin leaving circular bald patches. On other parts, a dry red patch forms which spreads at the edge while healing in the centre, so that a complete ring is formed. The disease is infectious.

Treatment.

When it occurs on non-hairy parts, tr. iodi or ung. hydrarg. are aplied. When the scalp is affected, the part is treated by X-rays or by the above-mentioned applications.

CORNS.

A corn is an overgrowth of the epidermis which grows downwards and presses upon the papillæ of the dermis, thus causing pain. Corns are produced by the pressure of badly-fitting boots, and may be "hard" or "soft." The hard corn is found on the upper or under surface of the toes; the soft corn usually forms between the toes.

Treatment.

The boots and socks must be made to fit properly, otherwise treatment will be of no use. The corn is carefully pared or shaved off with a sharp scalpel, taking care not to injure the underlying dermis.

Corn paint consists of salicylic acid dissolved in collodion. This, when painted on daily, causes death of the epidermis which can then be easily pared off.

Chapter XVII.

DISEASES OF THE KIDNEYS.

Before discussing the actual diseases of the kidneys it is necessary to give an account of the changes which may take place in the urine.

Quantity.

The normal quantity passed in 24 hours is about 50 ounces.

It is *increased* by :—

(*a*) Increased quantity of fluids drunk.
(*b*) Exposure to cold.
(*c*) The action of diuretic drugs.
(*d*) Certain diseases, such as Chronic Nephritis and Diabetes.

It is *decreased* by :—

(*a*) Decreased quantity of fluids drunk.
(*b*) Exposure to heat.
(*c*) The action of diaphoretic drugs.
(*d*) Certain diseases, such as Acute Nephritis and Heart Disease, and in all Fevers.

Colour.

The normal colour is amber or pale straw. When the daily quantity of urine is large the colour is paler, and when small it is darker.

The following colours may also be observed :—

Colour.	*Cause.*
Red - - -	Hæmorrhage in the bladder.
Dark brown - -	Hæmorrhage in the kidneys.
Greenish black -	Carbolic acid. Salol.
Yellowish green -	Bile. Santonin.

Specific Gravity.

By this is meant the weight of a quantity of urine compared with the weight of an equal quantity of water. Urine is always heavier than water because it consists

of solid matter dissolved in water. If the weight of a quantity of water be represented by 1,000, then the weight of an equal quantity of normal urine—that is, the Specific Gravity—will be between 1,015 and 1,025.

The Specific Gravity is estimated by means of a Urinometer. This consists of a hollow glass or metal bulb, weighted at the bottom so that it floats upright, and provided with a scale above. The scale is graduated from 0 at the top to 60 at the bottom, the first figures being omitted so that they would be read as 1,000 and 1,060. When placed in water the urinometer sinks to 1,000, but when solid matter is dissolved in the water the instrument does not sink so far, so that the reading on the scale will be higher than 1,000.

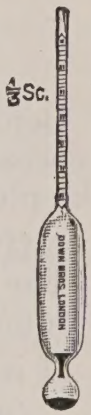


Fig. 180. Urinometer.

To take the Specific Gravity of urine, the urinometer is placed in the urine and the level to which it sinks is read off on the scale. The true level of the surface of the urine must be noted and not the heaped up part round the shaft of the urinometer.

Reaction.

Urine may be acid, alkaline or neutral, and the reaction is tested with litmus paper, of which there are two kinds, red and blue.

Blue litmus paper turns *red* in *acid* urine.

Red litmus paper turns *blue* in *alkaline* urine.

No change takes place in neutral urine.

Deposits.

When urine is allowed to stand for a time certain deposits may fall to the bottom of the urine glass.

Mucus.—This is secreted by the mucus membrane of the urinary passages and appears as a faint woolly-looking cloud *suspended* in the urine.

Pus.—This is not a very common deposit. It appears as a dense white or yellowish mass at the bottom of the glass.

Tests :—

Pus is not dissolved on adding Acetic Acid.

It becomes ropy and gelatinous on adding Liquor Potassæ.

On examination under the microscope pus cells are seen.

Phosphates.—The phosphates of calcium and magnesium may be found in neutral or alkaline urine, and appear as a cloudy deposit, lighter than pus, at the bottom of the glass.

Test :—

They dissolve on adding Acetic Acid.

Urates.—The urates of sodium, potassium, and ammonium may be deposited in acid urine. They are usually brick-red in colour and may appear even in healthy urine when it becomes cold.

They are common in all fevers.

Test :—

Urates disappear when the urine is heated, but are deposited again when it becomes cold.

Abnormal Constituents of Urine.

In certain diseases any of the following substances may be found in the urine :—albumen, blood, casts, sugar, bile.

Albumen.—This can never be seen in urine before applying the tests.

Tests :—

(1) Nearly fill a test tube with urine and boil the *upper* part over a spirit lamp. If albumen is present a white cloud appears *which does not disappear on adding Acetic Acid.*

(2) Put about a quarter of an inch of strong Nitric Acid into a test tube. Hold the tube almost horizontal and gently pour some of the urine on top of the acid. If albumen is present a white ring appears where the two liquids meet.

Blood.—If the quantity of blood is large the urine is bright red or dark brown in colour. If the quantity is small the urine is opaque and has a peculiar "*smoky*" appearance.

Tests:—

(1) Put one inch of urine into a test tube and add two drops of Tincture of Guaiacum. On shaking, the mixture becomes milky. Gently pour one inch of Ozonic Ether into the tube and, if blood is present, a blue colour appears where the liquids meet.

(2) On examination under the microscope blood corpuscles are seen.

Casts.—These consist of the epithelial lining of the uriniferous tubules of the kidney. They can only be seen under the microscope and appear as minute cylinders.

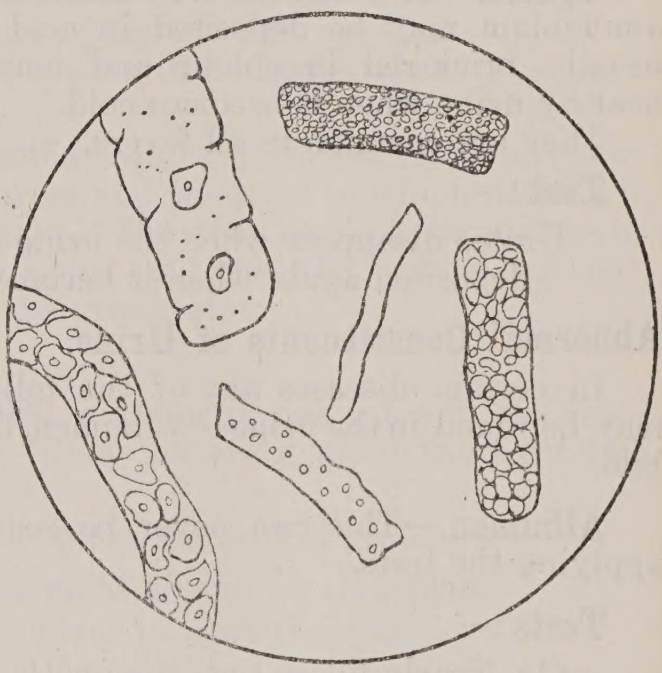


Fig. 181.
Urinary Casts.

Sugar.—This is present in the urine of patients suffering from Diabetes, in the form of glucose or grape sugar.

Test:—

Put one inch of Fehling's Solution into a test tube and boil it. If it changes colour the test tube is probably dirty and another must be taken.

If it does not change colour add a little urine and again boil. If sugar is present an orange coloured precipitate will form.

Fehling's Solution consists of sulphate of copper, tartarated soda, and caustic soda dissolved in water. It is often made up in two solutions marked **A** and **B**, in which case take half an inch of each and boil as before.

Bile.—This appears in the urine in cases of Jaundice.

Tests:—

(1) Put some urine in a test tube and on top gently pour a little Tincture of Iodine. If Bile is present a green colour will be formed.

(2) Filter several ounces of urine through a filter paper (or piece of clean white blotting paper). Straighten out the paper and on a dry part of it place a drop of strong Nitric Acid. If bile is present the colours of the rainbow will be seen where the fluids meet.

Routine Method of Testing Urine.

(1) Note the colour and the presence of any deposit
(2) Test the reaction with litmus paper.
(3) Take the Specific Gravity with the Urinometer.
(4) Examine for Albumen.
(5) If there is a deposit, apply the tests for Urates, Phosphates, and Pus.
If there is no Albumen there will be no Pus.
(6) If Albumen is present, test for Blood.
If there is no Albumen there will be no Blood.
(7) If the Specific Gravity is over 1030, test for Sugar.
(8) If the urine is greenish in colour, test for Bile.

How to collect a Specimem of Urine.

(1) Whenever possible the specimen should be taken from the total urine passed in 24 hours.
(2) When this is not possible the specimen should be taken from the urine first passed in the day.

(3) The urine is collected in a clean urine glass, the bottom of which is conical so that any sediment forming can easily be drawn into a pipette.

Fig. 183.
Pipette.

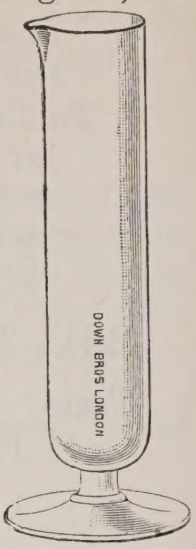


Fig. 182.
Urine Glass.

(4) Nearly fill the urine glass, so that the urinometer will not touch the bottom. *Never add water to a specimen in order to make up the quantity.*

(5) Attach to the glass a piece of paper bearing the patient's name, the number of the ward, and the date, and cover the glass.

NEPHRITIS.

Inflammation of the Kidney, or Bright's Disease, may be Acute or Chronic.

ACUTE NEPHRITIS.

Causes.

It occurs most frequently after Acute Fevers, of which Scarlet Fever is the commonest. Other fevers are Diphtheria, Erysipelas, Pneumonia, Measles, Rheumatism, and Enteric Fever. Exposure to cold and wet may also cause it.

Symptoms.

These come on with headache, vomiting, and slight fever; and there may be pain in the loins. Swelling of the lower eyelids is noticed in the mornings, and of the

feet and ankles at night. This is due to *Œdema*, or dropsy, which is a collection of serum in the loose cellular tissue under the skin. Serum may also collect in the pleural and peritoneal cavities.

The following changes occur in the urine :—

(*a*) The quantity is diminished—to 10 ounces daily or even less.
(*b*) It is high coloured and "smoky" or even red.
(*c*) It contains a large amount of Albumen.
(*d*) It contains Blood.
(*e*) It contains Casts.

Progress.

The disease usually lasts for five or six weeks and may end in

(*a*) Recovery.
(*b*) Chronic Nephritis.

Treatment.

The patient is kept in bed until the albumen has disappeared from the urine, or until it has been decided that recovery is impossible. The scheme of treatment is to relieve the kidneys of most of their work. Consequently the patient is put on milk diet and the waste matter removed from the body by purgatives and diaphoretics. Water, barley water, or imperial drink may be given freely.

The urine passed each day must be carefully measured and the quantity entered on the chart. A specimen must be saved for examination daily.

CHRONIC NEPHRITIS.

Causes.

It may occur without any apparent cause or may follow an attack of Acute Nephritis. Other causes are Syphilis, Gout, Chronic Lead Poisoning, and the excessive use of Alcohol.

Symptoms.

There are two forms of Chronic Nephritis, but both are accompanied by anæmia, weakness and indigestion.

In one form the urine is small in quantity and contains a large amount of albumen, and there is much œdema.

In the other form the urine is large in quantity and contains a small amount of albumen, and there is little œdema.

The disease may last for years, but in the later stages the heart becomes affected and hæmorrhages may occur in the brain.

Treatment.

The disease is incurable. The diet consists chiefly of milk and slops, with very little meat; the bowels must be opened at least once daily; the patient must not get cold; tonics are prescribed.

URÆMIA.

This condition may occur in almost any disease of the Kidney, and is due to the absorption by the blood of certain substances which, in health, are converted into urea and so excreted by the kidneys.

Symptoms.

Before these occur the amount of urine passed daily becomes very small, or the kidneys may cease to excrete any urine (*suppression of urine*). Uræmia commences with headache, vomiting and dyspnœa, followed by twitching of the muscles, convulsions, drowsiness, and coma.

Treatment.

Endeavours are made to get rid of the poison by purgatives and diaphoretics. Large doses of Pulvis Jalapæ Co. and the administration of hot-air or vapour baths are the usual means adopted.

RENAL CALCULUS OR STONE IN THE KIDNEY.

Stones forming in the Kidney may give rise to no symptoms, or blood and pus may appear in the urine.

RENAL COLIC.

When one of these stones passes down the Ureter to the Bladder it may cause the severe pain known as Renal Colic.

Symptoms.

The patient suffers intense pain, which shoots down to the testicle. There is also vomiting, shivering, sweating, and collapse.

Treatment.

Hot fomentations may be applied to the loins, but a hypodermic injection of morphia is nearly always necessary.

DIABETES.

This is not a disease of the kidneys, but is dealt with here as it is accompanied by changes in the urine. It may be described as a constitutional disease characterised by the passage of large quantities of urine containing sugar.

Cause.

This is unknown, but in many cases the pancreas is diseased. Sugars and starches taken in food are carried by the portal vein to the liver, where they are converted into other substances, for use in the body. In diabetes this function of the liver is interfered with, so that the sugar passes directly into the blood and is excreted in the urine.

Symptoms.

The disease commences very gradually, and the only symptoms which ever become marked are increased appetite and thirst, with loss of flesh and strength, and the passage of from 6 to 40 pints of urine daily.

The urine is pale and clear, with a sweet smell (like newly mown hay); the specific gravity is high (from 1030 to 1045 or more), and sugar is present.

The disease may last for years, and the patient dies from one of the complications.

Complications.

(*a*) Phthisis.
(*b*) Coma.
(*c*) Gangrene.
(*d*) Boils and Carbuncles.

Treatment.

The treatment is chiefly a question of dieting. Sugar and starchy foods are not allowed, and the nurse must see that the medical officer's orders in this respect are *strictly* carried out.

The following tables give some idea of what is allowed and what is not :—

Allowed.	*Not allowed.*
Clear soup.	Sugar and starch in any form.
Fish. Meat.	Bread. Pastry. Puddings.
Eggs. Butter. Cheese.	Rice. Sago. Tapioca, &c.
Green vegetables, such as cabbage.	Root vegetables, such as potatoes, beetroot, carrots, &c.
Strawberries. Raspberries. Gooseberries. Oranges. Lemons.	Peas. Beans.
Tea. Coffee. Cocoa.	Fruits, except those named.
Milk in small quantities.	Beer. Stout.

Saccharine, saxin, or glycerine are used instead of sugar to sweeten food, and gluten bread or almond biscuits instead of wheaten bread.

The most important drug is codeine, one of the alkaloids of opium (like morphia).

The patient is not confined to bed, but is allowed to take mild exercise in the fresh air.

Chapter XVIII.

DISEASES OF THE NERVOUS SYSTEM.

PARALYSIS is the loss of power of movement, sensation, or function in any part of the body. It is caused by injury or disease of the brain, the spinal cord, or the nerves; so that there are three forms of Paralysis.

1. Hemiplegia, or paralysis of one side of the body, is always the result of injury or disease of the brain, the commonest cause being Apoplexy. If the left side of the brain is affected the patient may lose the power of speech.

Nursing.

In addition to the general rules for nursing a helpless patient, the nurse must bear in mind the following points :—

(*a*) Retention of urine is very common, therefore note whether urine is passed. If the patient has not passed urine since the Medical Officer's last visit, report the fact.

(*b*) Take special care in applying hot-water bottles. Burns are liable to occur as the patient is unable to feel.

(*c*) Remember that the patient may have lost his speech, and so cannot ask for anything he may want.

(*d*) Take every precaution to prevent the formation of bedsores.

2. Paraplegia, or paralysis of both sides of the body below a certain level, is the result of injury or disease of the spinal cord, as in cases of Fracture-dislocation of the Spine. The patient loses control over his bladder and rectum, and bedsores are very liable to occur owing to the involuntary passage of urine and fæces into the bed.

Nursing.

The special points to be remembered are :—

(*a*) Care in the application of hot-water bottles.
(*b*) The frequent soiling of the bed.
(*c*) The great tendency to bedsores.

3. NERVE PARALYSIS may be due to injury or inflammation of a nerve, the latter being called **Neuritis.**

Causes of Neuritis.

Alcohol.
Lead Poisoning.
Diphtheria.
Cold.

Symptoms.

There is usually pain and tenderness in the course of the nerve, and paralysis of one or more muscles, with loss of feeling in the skin.

CAISSON DISEASE, **Compressed Air Illness,** or **Diver's Paralysis.**

This is a form of illness which may affect divers and men working in sunk caissons.

When under water the diver is surrounded by compressed air forced into his helmet by a pump. As the pressure increases, the blood and fatty tissues of the body absorb nitrogen from the air; but this causes no ill effects so long as the man remains under pressure. If, however, the pressure is rapidly diminished as when a diver is "blown up" or is brought to the surface too quickly without the regulation stoppages, the nitrogen is liberated from the blood, collects in the heart and blood vessels, and may cause instant death or the symptoms known as Caisson Disease. When the diver is brought to the surface slowly with the regulation stops, the nitrogen passes back into the air through the lungs and no harm results.

Symptoms.

These come on in from a few minutes to half-an-hour or more after the diver has reached the surface, and vary considerably in different cases. The commonest

symptoms are dyspnœa, pain in the stomach, deafness, faintness, loss of consciousness, paraplegia, and severe pains in the muscles and joints commonly known as "bends."

Treatment.

Re-compression is the only treatment likely to be of avail in severe cases. The Medical Officer may order the man to be sent down again quickly to the depth from which he came, and then slowly brought to the surface with the regulation stops; or if a Re-compression Chamber is available he may place the patient in it, raise the pressure quickly and then slowly de-compress him. Where re-compression is not available, rest, fresh air, inhalation of oxygen, and stimulants are ordered.

LOCOMOTOR ATAXIA.

This is a disease of the spinal cord in which the patient loses control over his muscles. Thus, in walking, instead of bringing his leg forward steadily, it is thrown forward, and the foot comes to the ground with a slap; he fumbles when trying to touch an object, and cannot stand with his eyes closed.

He suffers from severe pains around the body, and darting pains in the legs.

The disease lasts for years, and is incurable. Many patients develop General Paralysis of the Insane.

MENINGITIS.

By this is meant inflammation of the membranes of the brain or spinal cord.

Causes.

(*a*) The inflammation may spread from other parts, such as Otitis Media or a septic compound fracture of the skull.
(*b*) Blows on the head.
(*c*) Pyæmia.
(*d*) Tuberculosis.

Symptoms.

These vary according to the part of the meninges affected. Violent headache, vomiting, and a high tem-

perature are generally present. The patient is irritable, and may have convulsions. He becomes stupid and drowsy, unconscious and usually dies.

Treatment.

He is kept quiet in a darkened room; the head is shaved, and an ice bag applied. In some cases the operation of trephining is performed, especially if pus has formed.

Tuberculous Meningitis is invariably fatal.

INSANITY.

The chief forms of Insanity are :—

1. Mania.
2. Melancholia.
3. Delusional Insanity.
4. Alcoholic Insanity.
5. Epileptic Insanity.
6. Dementia.
7. General Paralysis of the Insane.

Mania.

In this condition the patient is excited. In the simpler forms he resembles a man in the "jolly" stage of alcoholism; in others he is wildly excited, noisy, and often indecent.

Melancholia.

The patient is depressed. He often has delusions and considers himself unworthy, as he thinks he has committed some awful crime. He sleeps badly and refuses his food. These patients are very liable to attempt suicide, and must therefore be carefully watched.

Delusional Insanity.

This term is applied to those cases in which delusions are the most prominent symptom. They may be neither excited nor depressed. The delusions are usually of persecution: he is being watched by someone outside the building; he is being shot at with poisoned arrows; he is being tortured by electric currents; or he has a lizard living in his abdomen.

Alcoholic Insanity.

This is a form of Mania brought on by alcoholic excess, but must not be confounded with Delirium Tremens. The patient is violent and may attempt murder or suicide. The attack rarely lasts long but is very liable to recur.

Epileptic Insanity.

The post-epileptic state has already been mentioned (page 214). Many patients are irritable, cunning, and dangerous to others, and must therefore be very carefully watched.

Dementia.

By this is meant loss of mind. It is found in all cases of chronic mental disease and is not uncommon in old age. The patient has lost all power of thought and memory, and is usually very easy to manage.

General Paralysis of the Insane.

This (commonly called G.P.I.) is a definite disease of the brain. The cause is, in practically every case, Syphilis; and the body, as well as the mind, is affected.

The patient gradually develops delusions, usually of grandeur. He thinks he is the King; he has 10,000 gold watches; he can run 100 yards in $5\frac{1}{2}$ seconds; in fact he is, and can do anything, much better than anyone else. These delusions often persist to the end.

Soon his muscles begin to waste. His tongue and lips are tremulous, his speech slow and uncertain, and his gait staggering. He is then confined to bed and gradually becomes quite helpless.

The disease is quite incurable, but death generally occurs from Pneumonia or Diarrhœa.

GENERAL MANAGEMENT OF THE INSANE.

1. Treat all patients with kindness and tact. Be firm with those capable of understanding, but never "nag" or irritate them.

2. Remember that in many cases you must think for your patient.

3. Beware of the patient with a tendency to suicide. *Never for a moment allow that man out of your sight.* He should be searched occasionally throughout the day, and his bed examined at night, to see that he has not concealed any weapon. Knives, forks, scissors, glass, scarves, towels or any other instrument capable of causing hæmorrhage or strangulation must be kept out of his way, and, if possible, locked up when not in use. The suicidal patient is very cunning.

4. Beware of patients choking themselves while eating; they are very liable to bolt their food. Meat is always given minced and can then be eaten with a spoon.

5. Fires and lights must be always guarded.

6. Never allow a patient to have a bath unattended, nor to fill a bath for himself. He may attempt to drown or scald himself.

7. Never put a patient into a padded room without an order.

8. Never apply a straight-jacket or straps to a patient without an order.

9. If a patient is very violent do not attempt to restrain him alone; the result will probable be a fracture or other serious injury to him. Obtain assistance so that his limbs are *thoroughly* restrained, and there is less risk of injury.

10. Note and report any important remarks made by the patient, especially those which show a tendency to suicide.

11. Report the following occurrences *at once*:—

Accidents, violence, illness, fits, refusal of food, and the loss of any article which might be used as a weapon.

Chapter XIX.

DISEASES OF THE EYE.

STYE.

A stye is a pustule which forms on the margin of the eyelid around an eyelash. It is painful, and often accompanies chronic constipation.

Treatment.

The eyelash is pulled out with a fine pair of forceps, and boric fomentations applied to the eye.

CONJUNCTIVITIS.

Inflammation of the conjunctiva may be simple granular, or gonorrhœal.

1. SIMPLE CONJUNCTIVITIS.

This is caused by irritation, such as exposure to wind, smoke, or dust; by foreign bodies in the eye; by overstrain of the eye; and it also occurs in measles and catarrh.

Symptoms.

The eye is bloodshot and watery. The patient complains of pain (a sensation as of sand in the eye), and heat. A thin discharge appears, which tends to stick the eyelids together; and in severe cases there may be actual pus.

Treatment.

After removing the cause the eye is irrigated with boric lotion. Rest to the eye is obtained by wearing a shade.

2. GRANULAR CONJUNCTIVITIS.

This disease—also called trachoma—is infectious, and is spread by means of towels, sponges, handkerchiefs, &c. In England it is sometimes found among the very poor, dirty, and overcrowded, but is very common in Egypt.

Symptoms.

In addition to the symptoms of simple conjunctivitis, minute granules like sago are found on the inner surfaces of the eyelids. There is also much *lachrymation* (= excessive flow of tears), and *photophobia* (= pain on looking at the light).

Treatment.

Irrigation with boric lotion and touching the granules with silver nitrate or copper sulphate.

3. GONORRHŒAL CONJUNCTIVITIS.

This form is caused by the *Gonococcus*. The patient usually infects himself by rubbing his eye with a finger on which is a little pus from his urethra.

This disease is fully described under **Gonorrhœa.**

KERATITIS.

Inflammation of the cornea may be due to injury, septic infection, or syphilis.

Symptoms.

At first there is photophobia and pain on movement, but in the later stages these may disappear. Ulcers may form on the cornea, or it may become dull and opaque, causing impaired vision.

Treatment.

The cause, such as syphilis, is treated, the eye irrigated, and atropine drops ordered. Atropine dilates the pupil and so tucks the iris out of the way, and diminishes the chance of it becoming inflamed.

IRITIS.

Inflammation of the iris occurs in syphilis, rheumatism, and gout.

Symptoms.

Severe pain shooting up the forehead, with some lachrymation, photophobia, and dimness of vision are the chief symptoms.

The eye is bloodshot, and the iris is dull in colour. The outline of the pupil is often irregular, and accommodation to light is sluggish.

Treatment.

The cause is treated. Atropine drops are used to prevent the inflamed iris becoming adherent to the lens or posterior surface of the cornea. For the pain, leeches or blisters are applied to the temple.

CATARACT.

By this is meant an opacity of the lens.

A cataract may be due to old age, diabetes, or injury.

Symptoms.

There is increasing dimness of vision as the lens becomes more opaque, until finally total blindness may result. The disease is usually very chronic, lasting for years.

Treatment.

Operation is the only treatment. The useless lens is removed through a small incision in the cornea, and afterwards the patient must wear glasses to replace the lens.

RETINITIS.

Inflammation of the retina may be due to syphilis, nephritis, or diabetes.

Symptoms.

Dimness of vision is the chief symptom.

Treatment.

The cause is treated, but these cases are usually incurable.

OPTIC NEURITIS.

Inflammation of the optic nerve may be due to a cerebral tumour or abscess, nephritis, syphilis, or tuberculosis.

Symptoms.

Impaired vision leading to absolute blindness.

Treatment.

The cause is treated, but these cases are usually incurable.

STRABISMUS OR SQUINT.

Squint may be due to

(1) Paralysis of some of the ocular muscles, or
(2) Hypermetropia.

In this case the constant muscular effort to make the eyes converge to see a near object causes a permanent turning in of the eyes.

Treatment.

When one muscle, for example the external rectus, is paralysed the eye is turned inwards by the internal rectus. This muscle is, therefore, divided to allow the eye to become straight. When due to bad sight, suitable glasses must be worn.

FOREIGN BODIES IN THE EYE.

The commonest foreign bodies are particles of dust, metal, or coal, insects and eyelashes. They may be under the upper lid, under the lower lid, or on the cornea.

Treatment.

The patient may be able to get rid of the body himself:—

(1) by blowing his nose violently;
(2) by the use of smelling salts (ammonia), which increase the flow of tears;
(3) by dipping the face into water, and then opening the eye and trying to wash it out.

If these methods are unsuccessful, seat the patient in front of a good light, and proceed as follows:—

(1) Pull down the lower lid, and if the foreign body is there remove it with a folded piece of *white* gauze, a camel-hair brush or the corner of a clean handkerchief. Never use dry wool or lint as some of the fibres may remain in the eye.
(2) If the foreign body is not under the lower lid it is best to *inform the Medical Officer* at once. If, however, no Medical Officer is available continue the examination.
(3) Examine the front of the eyeball carefully, as the foreign body may be very minute.

(4) Examine the upper lid. Stand behind the patient with his head resting against your body. Tell him to look down, and place a probe across the upper lid in the hollow just below the eyebrow. Now take hold of the edge of the lid with the finger and thumb and turn it upwards and backwards over the probe, which must be above and not over the tarsal plate. Gently remove the probe and examine the conjunctiva lining the eyelid, removing any foreign body as before. Finally, turn down the eyelid again.

(5) If the foreign body is embedded in the cornea a Medical Officer *must* be consulted. He will remove it with an **eye spud** after anæsthetising the eye with cocaine. A little castor oil is then dropped on to the cornea.

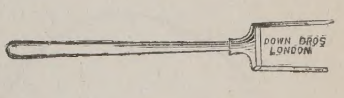
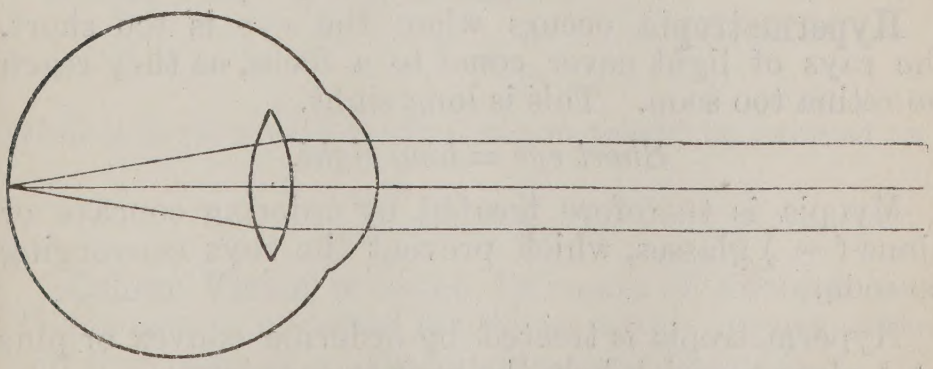


Fig. 184.
Eye Spud.

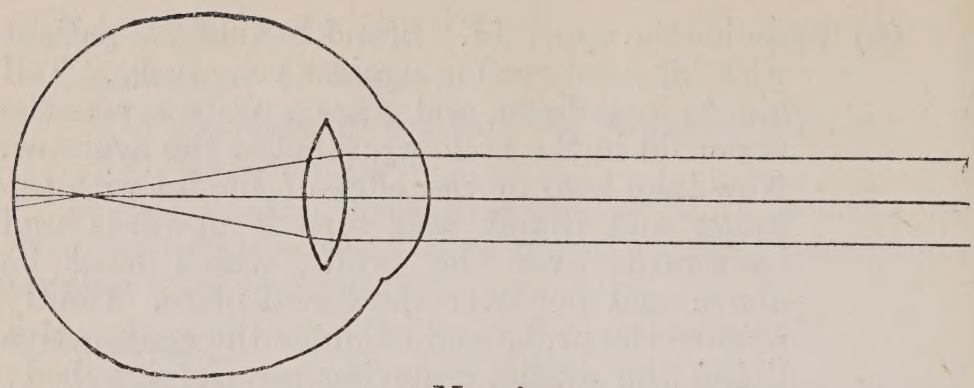
ERRORS OF REFRACTION.

It has already been stated (page 97) that rays of light passing through the lens are refracted—that is, turned out of their course—so that they all meet on the retina and form a sharp image. When they do not so meet, owing to being deflected too much or too little, a blurred image results. This form of bad sight is therefore called an **error of refraction.**

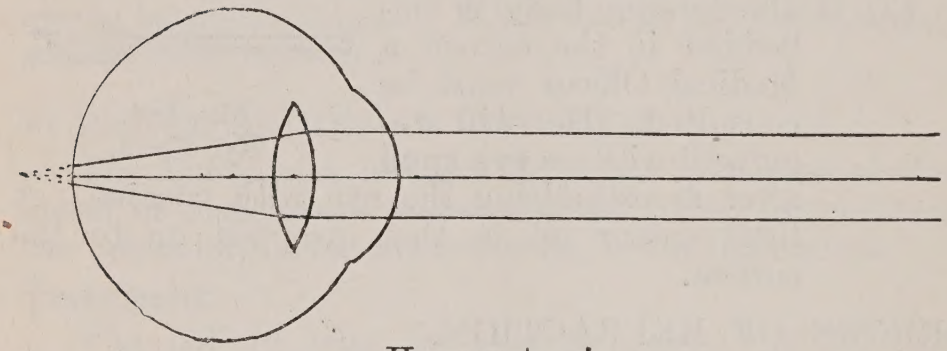
Fig. 185.
Errors of Refraction.



Emmetropia.



Myopia.



Hypermetropia.

Emmetropia occurs when the rays of light do come to a focus on the retina when the lens is at rest. This is perfect sight.

Myopia occurs when the eye is too long. The rays of light come to a focus in front of the retina. This is short sight.

Long eye = short sight.

Hypermetropia occurs when the eye is too short. The rays of light never come to a focus, as they reach the retina too soon. This is long sight.

Short eye = long sight.

Myopia is therefore treated by ordering concave or minus (—) glasses, which prevent the rays converging too soon.

Hypermetropia is treated by ordering convex or plus (+) glasses, which help the rays to converge.

ASTIGMATISM.

This is due to the cornea being more sharply curved in one direction than another—like the back of a spoon. The result is that while vertical lines are in focus horizontal lines are out of focus, and vice versâ. This condition is treated by cylindrical lenses.

PRESBYOPIA.

This is the bad sight of old age. The ciliary muscles, the suspensory ligament, and the lens are all becoming less active and less elastic, so that the patient has trouble in focussing near objects.

SIGHT TESTING.

Vision is tested by reading Snellen's Test Types, which consist of different sizes of letters. The smallest should be read, in normal vision, at a distance of 6 metres, the next at 9 metres, and so on up to the largest, which should be read at a distance of 36 metres. In practice, the types are always read at a distance of 6 metres (= roughly 20 feet).

Acuteness of vision is represented by the formula

$$V = \frac{d}{D},$$

where d = the distance from the type, and D = the size of type read.

For example, the acuteness of vision of a person who can only read the type numbered 18, at a distance of 6 metres, would be shown thus :—

$$V = \frac{6}{18};$$

while a person with normal vision would be entered as

$$V = \frac{6}{6}.$$

Colour Vision is tested by means of coloured wools. The person to be tested is told to match various colours, and thus cases of colour-blindness are detected.

Another method is employed in which the person names the colour of small glass discs which are illuminated from behind in a lantern.

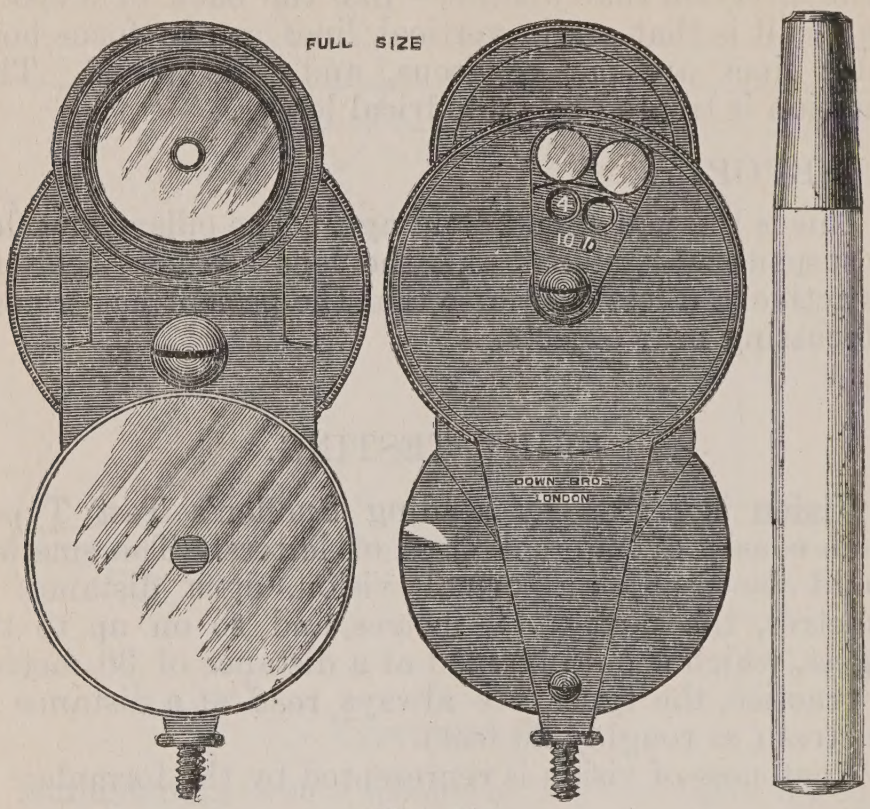


Fig. 186.
Ophthalmoscope.

DISEASES OF THE EAR.

IMPACTED CERUMEN.

Cerumen, or wax, in the ears causes deafness, buzzing in the ear, and, when forced against the tympanic membrane, pain. The deafness may come on quite suddenly.

Treatment.

The wax is removed by syringing with warm water or boric lotion. A little bicarbonate of soda dissolved in water or a few drops of warm olive oil dropped into the ear before syringing tend to soften the wax.

OTITIS MEDIA.

Inflammation of the middle ear occurs chiefly as a complication of scarlet fever, measles, and small-pox.

Symptoms.

The patient complains of pain in the ear. Pus usually forms and ulceration of the tympanic membrane occurs, followed by perforation. The pus now escapes from the ear and forms the most important sign.

Treatment.

Until pus appears the pain is treated by hot fomentations. Later the ear is frequently and carefully syringed with boric lotion, and every care taken to allow the pus to escape easily. The ear should not be plugged with cotton wool, but a little aseptic gauze may be lightly inserted.

Complications.

The pus may escape into the cranium and set up meningitis or a cerebral abscess. In other cases it passes into the cancellous bone of the mastoid process causing Mastoid Disease.

These are all very serious conditions.

FOREIGN BODIES IN THE EAR.

These may be beads, pieces of match stick, insects, &c.

Treatment.

Never under any circumstance attempt to remove a foreign body which cannot be clearly seen on looking into the ear. The case should, if possible, always be shown to a Medical Officer. In the case of an insect, a little warm olive oil may be poured into the ear in the hope of floating it out.

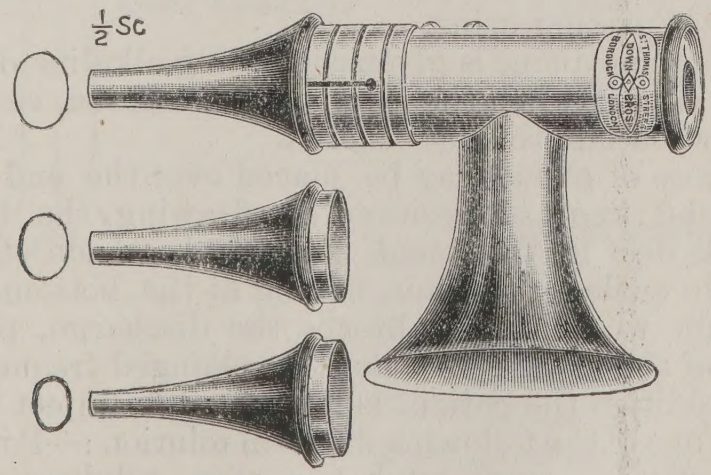


Fig. 187. Auroscope.

Chapter XX.

VENEREAL DISEASES.

The diseases which are contracted by sexual intercourse are gonorrhœa, chancroid, and syphilis.

GONORRHŒA is a specific disease caused by a definite germ—the *Gonococcus*, and resulting in inflammation of the mucous membrane of the urethra.

Symptoms.

In from 2 to 8 days after infection the patient complains of scalding pain on passing urine. The pain increases, and a little thin mucus, which soon becomes thick yellow pus, escapes from the urethra.

The disease usually lasts about 3 weeks, and ends in cure or in chronic gonorrhœa **(Gleet).**

Treatment.

The patient is put on "light duty" or on the sick list, and his rum and leave are stopped. Warn him of the danger of losing his sight if any of the discharge should get into his eye. Advise him to wash his hands each time after passing urine.

At first, medicine is given containing alkaline diuretics and sedatives; when the pain ceases, copaiba, cubebs, or sandal wood oil are administered.

A piece of gauze may be placed over the end of the penis, and kept in position by drawing the foreskin forwards over it; or a small bag may be made of mostig battist to enclose the penis, having at the bottom a piece of cotton wool. This absorbs the discharge, prevents soiling of the clothes, and must be changed frequently.

In addition the patient is instructed to inject into his urethra one of the following drugs in solution :—Potassium permanganate, zinc sulphate, zinc sulpho-carbolate, protargol, &c.

Method.

A glass syringe with a blunt olive-shaped nozzle is used. The patient is instructed to pass urine and immediately afterwards about ½ oz. of the solution is injected slowly into the urethra and kept there for 2 minutes by holding the end of the penis. This is done at least three times a day.

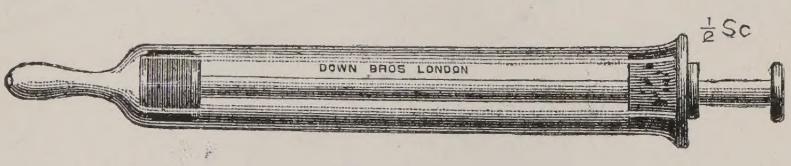


Fig. 188.
Urethral Syringe.

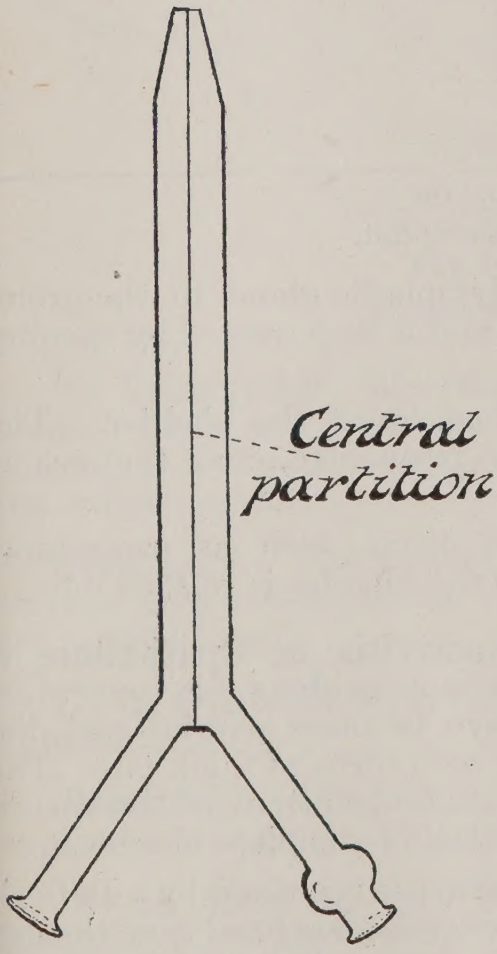


Fig. 189.
Marioche's Tube.

Another method of treatment consists in washing out the urethra with an irrigator. For this purpose a Marioche's Tube is fitted in place of the ordinary nozzle as it allows the fluid to escape more easily.

Complications.

(1) **Chordee.**—This is a painful erection of the penis.

Treatment. — The application of cold.

(2) **Epididymitis,** or inflammation of the posterior part of the testicle. This may occur at any time during the disease. The testicle is painful, tender, and swollen ; there is some fever and the discharge stops.

Treatment.—The patient is put to bed on low diet, and the testicle raised on a splint. Either hot fomentations or cooling lotions are applied.

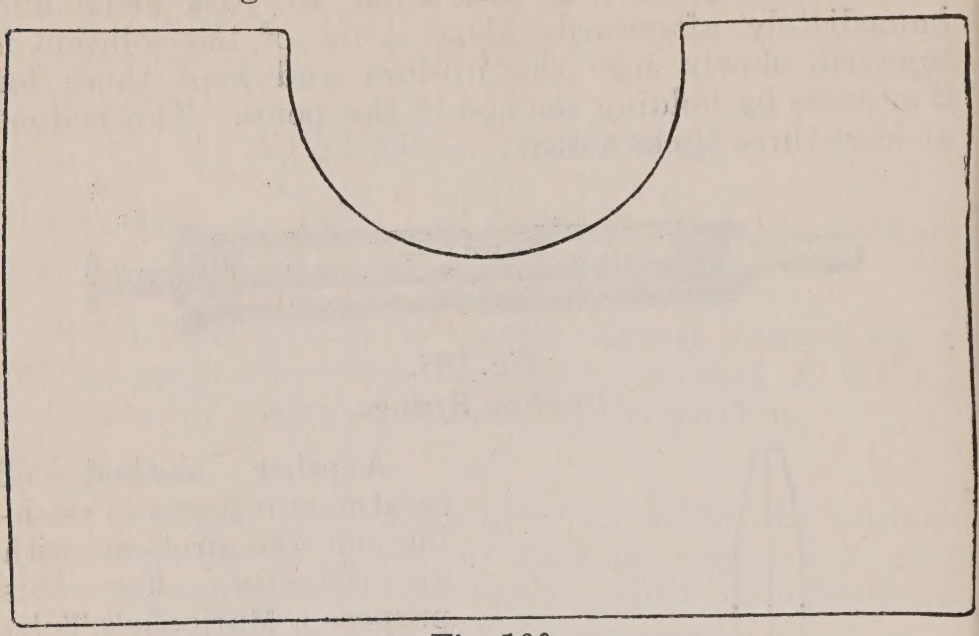


Fig. 190.
Testicle Splint.

(3) **Bubo,** or enlarged lymphatic gland in the groin. This sometimes suppurates and is then treated by opening and draining the abscess.

(4) **Cystitis,** or inflammation of the bladder. The patient has to pass urine frequently, and the act is painful.

Treatment.—Antiseptic drugs, such as urotropine, are given, and in bad cases the bladder is washed out.

(5) **Gonorrhœal Conjunctivitis or Ophthalmia** is usually caused by the patient rubbing his eye after touching his penis. The eye becomes painful, and discharges clear mucus, which soon turns to thick pus. The eyelids are red and swollen, and ulceration of the cornea may follow, resulting in partial or complete blindness.

Treatment.—The sound eye is protected by a Buller's Shield, which consists of a watch-glass fixed over the eye with strapping. The affected eye is irrigated frequently with boric or perchloride lotion. A little vaseline applied

to the edges of the eyelids will prevent them sticking together and retaining the pus.

(For method of irrigating the eye *see* page 256.)

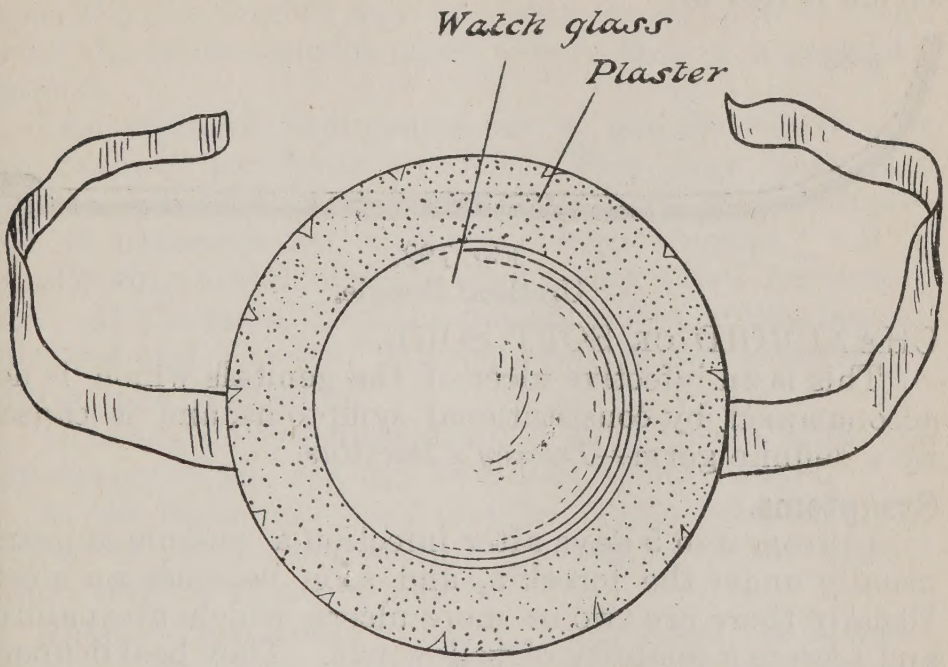


Fig. 191.
Buller's Shield.

(6) **Gonorrhœal Rheumatism** affects chiefly the ankle, wrist, and knee joints, which become tender, painful, and swollen; and is accompanied by a rise in the temperature.

Treatment.—The patient is kept in bed, and the original gonorrhœa treated. Heat and counter irritants are applied locally.

(7) **Warts** often appear on the penis after an attack of gonorrhœa.

Treatment.—They are usually destroyed by several applications of pure carbolic or glacial acetic acids.

(8) **Stricture of the Urethra** is caused by the contraction of scar tissue following ulceration of the mucous membrane. The symptoms come on gradually, increasing difficulty in passing urine being the chief.

Treatment.—The size of the urethra may be restored by dilating the stricture with bougies, or by cutting through it and allowing it to heal around a catheter, which is tied in.

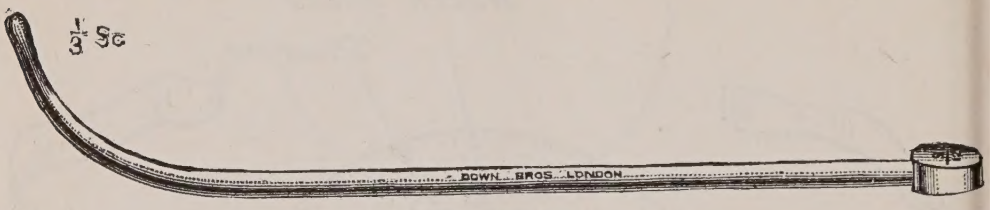


Fig. 192.
Urethral Bougie.

CHANCROID OR SOFT SORE.

This is an infective ulcer of the genitals which is not accompanied by constitutional symptoms, and is caused by a definite germ—*Ducrey's Bacillus.*

Symptoms.

In from 2 to 5 days after infection a pustule appears, usually under the foreskin, and soon becomes an ulcer. Usually there are two or more ulcers, which are painful and secrete a quantity of yellow pus. They heal in about 3 weeks.

In a patient with a tight foreskin all that may be seen is considerable swelling of the part, and pus escaping from between the glans penis and the prepuce.

A bubo is very liable to form in the groin.

Treatment.

Cleanliness is most important. The part is freely washed with some antiseptic lotion, and the ulcer dressed with lint soaked in "black wash" or dusted with iodoform.

SYPHILIS.

This is an infective disease causing general constitutional symptoms as well as a local sore. It is caused by a definite germ—the *Spirochæta Pallida.*

Incubation Period.—From 2 to 8 weeks—usually about 3 weeks.

Signs and Symptoms.

In describing a case of syphilis, three stages of the disease are recognised, called the primary, secondary, and tertiary stages.

PRIMARY SYPHILIS.

This is the stage of the sore or *Chancre*. Although it generally occurs on the penis, other parts of the body, especially the fingers and lips, may be infected through using the table utensils, pipes, towels, &c., of a syphilitic patient.

The chancre commences as a papule which soon breaks down and forms an ulcer. This ulcer feels hard to the touch—as if surrounded by a ring of cartilage—and is consequently called a "*hard chancre.*" It is usually single, and secretes only a very small amount of pus. At the same time, the glands in the groins become enlarged and "shotty," but suppuration rarely occurs.

SECONDARY SYPHILIS.

This stage commences from 5 to 9 weeks after the appearance of the chancre and lasts about 2 years.

At the beginning there may be slight fever and the patient is paler than usual. The signs of the disease which may occur are as follows:—

Rash.—This occurs in nearly every case. It appears chiefly on the front and back of the trunk, and consists of irregular red patches which become copper-coloured. There is neither pain nor itching.

Mucous Patches.—These are shallow ulcers which form on the tonsils, uvula, soft palate, tongue, and the inner sides of the cheeks or lips, and are infectious. The patient complains of sore throat.

Condylomata.—These are soft, warty growths which occur chiefly round the anus, and are very infectious.

Iritis, or inflammation of the iris, often follows, and

The Hair falls out.

TERTIARY SYPHILIS.

This stage commences as the secondary stage ends, and may last for any number of years. In cases which have been thoroughly treated during the previous stages, only about 10 per cent. show signs of tertiary syphilis.

The chief signs are the formation of (1) ulcers or (2) gummata, or the growth of new tissue in (3) the arteries, and (4) the brain and spinal cord.

(1) **Tertiary Syphilitic Ulcers** occur most commonly on the legs.

(2) **A Gumma** is a tumour, the interior of which becomes soft and forms a cheesy substance like thick pus. It may form in almost any part of the body; the testicles, brain, liver, and bones being the commonest sites.

(3) **Atheroma** is a condition in which the walls of the arteries become thickened. They lose their elasticity, become chalky, and are very liable to rupture.

Aneurysm is a condition in which the walls of an artery become stretched and thin, forming a bulging swelling.

(4) **The Brain and Spinal Cord** may be affected by the growth of fibrous tissue, causing various diseases of the nervous system.

Summary of the Chief Signs of Syphilis.

Stage.	*Date of Appearance after Infection.*	*Signs.*
Primary	2 to 3 weeks	Hard chancre.
Secondary	2 to 3 months	Rash. Sore throat. Condylomata. Hair falls out.
Tertiary	2 to 3 years	Ulcers on the skin. Gummata. Aneurysm. Diseases of the nervous system.

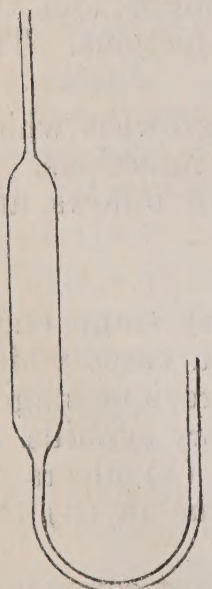


Fig. 193.
Wassermann Tube.

Diagnosis.

To decide whether a patient is suffering from syphilis, *Wassermann's Test* is now used. For this, some of the patient's blood is collected in a special tube by pricking his ear or finger.

TREATMENT.

A.—Primary Syphilis.

The chancre is dressed with lint soaked in lotio nigra (calomel and lime-water) or it is dusted with iodoform. Mercury may be ordered internally.

B.—Secondary Syphilis.

During this stage the following rules must be observed :—

(1) Mercury is given for at least 2 years.
(2) No alcohol should be taken.
(3) The patient should not smoke while the throat is sore.
(4) The teeth must be kept clean.
(5) The patient should be warned that he may infect other people.

Methods of administering Mercury.

(1) **By the Mouth.**—Mercury is given in the form of hydrargyrum cum creta, grains 1 or 2, three times a day, or of hydrargyri perchloridum, grain $\frac{1}{16}$ in mixture.

Disadvantages :—

(*a*) Mercury given by the mouth is apt to cause indigestion and diarrhœa.
(*b*) The patient must attend daily for treatment.
(*c*) The patient may not swallow the mercury, but spit it out at the earliest opportunity. When tabellæ are ordered they should, therefore, always be crushed and given in the form of a powder.

(2) **By Inunction.** — Unguentum hydrargyri ʒ j is rubbed thoroughly into the skin daily.

Rules for Treatment by Inunction.

(*a*) The patient should have a hot bath before each inunction.
(*b*) A different part of the body must be used each time, thus :—

1st day	-	The calves.
2nd day	-	The inner sides of the thighs.
3rd day	-	The abdomen.
4th day	-	The forearms.
5th day	-	The calves again, and so on.

(*c*) The hairy parts of the body must be avoided.
(*d*) The course lasts for from 4 to 6 weeks.

Disadvantages:—

(*a*) The treatment occupies about half-an-hour daily.

(*b*) The patient's clothes are soiled.

(3) **By Intramuscular Injections.**—Mercury in the form of a cream is injected deeply into the muscles of the buttock. The skin must be prepared as for an operation; the syringe and needle made aseptic, and every precaution taken to avoid septic infection.

The barrel and piston of the syringe should not be boiled, but cleaned with ether and then put into carbolic lotion. The needle is boiled in oil to prevent blunting of the point.

The cream consists of:—

Mercury - - - -	20 parts.
Lanolin - - - -	30 „
Chlorbutol - - - -	2 „
Liquid paraffin - -	to 100 „

The dose is ♏v which contains gr. 1 of mercury.

The injections are given once a week for 6 weeks. Then after a few weeks' rest another course is given, and so on.

Advantages:—

(*a*) The patient gets regular treatment, and is called away from his work only once a week.

(*b*) It is certain that the patient has received the mercury.

(*c*) It does not cause indigestion.

Disadvantages:—

(*a*) Pain. The introduction of the needle causes only very slight pain.

(*b*) Abscess. If proper precautions are taken this should never occur.

Mercurialism.

The mercury given by the above methods is excreted in the urine. If it collects in the system, signs of chronic

mercury poisoning, or mercurialism, occur. The chief signs are :—

(*a*) Loss of weight.
(*b*) Swelling of the gums, which bleed easily.
(*c*) Pain on clenching the teeth.
(*d*) Salivation, that is, an increased flow of saliva.
(*e*) Foul breath.
(*f*) Diarrhœa.

The **Treatment** is to stop the medicine and report to the Medical Officer.

Treatment of Special Signs.

Mucous Patches in the mouth are treated with antiseptic mouth-washes and gargles, or by touching the ulcers with silver nitrate.

Condylomata should be washed with soap and water twice daily, carefully dried, and then dusted with equal parts of calomel and boric acid powder.

C.—Tertiary Syphilis.

The drugs which are used in this stage are potassium iodide and mercury.

Iodism.

If potassium iodide is given for some time, symptoms of chronic poisoning, or iodism, may occur. These symptoms are :—

(*a*) The patient appears to have a bad cold, with running at the nose and eyes.
(*b*) A rash, like acne, appears.

The latest drug employed in the treatment of syphilis is Professor Ehrlich's Arsenical Preparation No. 606, or Salvarsan. This is a yellow powder which is injected in the form of a solution either into a vein or into a muscle. The average dose is about 6 grains of the powder. The very strictest antiseptic precautions must be taken.

Chapter XXI.

COOKING FOR THE SICK.

The cooking of food is a very important part of a nurse's duty, and it is well that he should know the reasons why food is cooked, and not eaten raw.

1. Cooking destroys bacteria and parasites, such as tapeworms.
2. It breaks up the starch grains in vegetable foods. The outer coverings burst, and so the digestive juices can more easily reach the inside of the grains.
3. It loosens the muscular fibres in animal foods, and converts the insoluble connective tissue into soluble gelatin.
4. It renders food more appetising, acting by the senses of sight, smell, and taste.

Recipes.

Albumen Water.

The whites of 4 eggs.
1 pint of cold water.
The juice of half a lemon.
1 teaspoonful of sugar.

Beat up well the whites of the eggs; place in a jar or basin with the cold water, lemon juice, and sugar; and let it stand a while to dissolve. It is then ready for use.

N.B.—Use cold water, as white of egg coagulates at a temperature of 180° F., and is then insoluble.

Oatmeal Water.

1 tablespoonful of oatmeal.
1 pint of water.
1 pinch of salt.

Place the oatmeal, salt, and water in a saucepan, and allow to simmer for 1 hour. It is served cold, and may be flavoured with lemon juice or lime juice.

Clear Barley Water.

1 ounce of pearl barley.
The rind and juice of half a lemon.
½ pint of boiling water.

Wash the barley well, and place in a jug or basin with the lemon rind and juice, and pour on the boiling water. Let it stand till cold, and strain. A little sugar may be added.

Thick Barley Water.

2 ounces of pearl barley.
1 pint of cold water.

Wash the barley well, and place it in a saucepan with the water; bring to the boil, and strain. Replace the barley in the saucepan, with 1 pint of water, and boil without the lid until well reduced in quantity. Strain, and allow it to cool.

N.B.—Barley water should be made fresh every day, as it quickly turns sour. It may be added to milk.

Rice Water.

2 ounces of rice.
1 pint of cold water.

Wash the rice well, and place in a saucepan with the water. Allow it to simmer gently for 1 hour; strain, and add a little lemon juice as flavouring.

Peptonised Milk.

1 pint of milk.
1 peptonising powder.
¼ pint of water.

Warm the milk and water to 140° F. Pour it into a jug, and add the peptonising powder. Stand the jug in a basin of hot water, and leave it for from 10 to 30 minutes, according to the degree of peptonisation required. Then put it into a saucepan and bring to the boil, to stop the process and preserve the milk. After boiling, it will keep for hours in a cool place, and is always ready for use.

Peptonised milk has a rather disagreeable flavour, which can be disguised by adding a little sugar, brandy, or flavouring.

Pancreatised Milk.

1 pint of milk.
¼ pint of water.
2 teaspoonsful of liquor pancreaticus.
¼ teaspoonful of bicarbonate of soda.

Prepare as in the preceding recipe, but adding the liquor pancreaticus and bicarbonate of soda instead of the peptonising powder.

Albumenised Milk.

The white of 1 egg.
½ pint of milk.

Beat up the white of egg with a little salt, add the milk, and serve in a tumbler.

Whey.

1 pint of milk.
The juice of 1 lemon, or 1 wineglassful of sherry.

Place the milk in a saucepan with the lemon juice or sherry, and bring slowly to the boil. Draw the pan to the side of the fire, and allow to stand for awhile until the curds have separated. Strain carefully.

Whey is the liquid part of milk which remains after the curds have been removed.

Lemonade.

1 lemon.
1 ounce of sugar.
½ pint of boiling water.

Wash the lemon, and peel it very thinly, taking only the yellow part. Place the rind, juice, and the sugar in a jug; pour on the boiling water, and allow it to stand until cold. Then strain out the rind.

Tea.

Rinse out the teapot with boiling water to heat it. Put in the tea, pour on freshly boiling water, let it stand for 2 minutes to infuse, pour it off, and serve with milk.

Milk Tea.

Make in the same way as above, using boiling milk instead of boiling water.

Coffee.

$1\frac{1}{2}$ tablespoonsful of coffee.
$\frac{1}{2}$ pint of water.
$\frac{1}{2}$ pint of milk.

Tie the coffee loosely in muslin, put it into a saucepan with boiling water, and stand it on the side of the stove for 5 or 10 minutes. Then bring it once to the boil, pour into a hot coffee-pot, and serve with boiling milk.

Chocolate.

$\frac{1}{2}$ ounce of soluble chocolate.
$\frac{1}{2}$ pint of milk.

Break up the chocolate, and mix to a paste with a little of the milk. Boil the rest of the milk, and stir it on to the chocolate. Return it to the saucepan, and stir till boiling. Boil for 5 minutes, and serve hot with sugar.

Linseed Tea.

2 ounces of whole linseed.
1 pint of cold water.
1 inch of liquorice stick.
The rind and juice of half a lemon.
$\frac{1}{2}$ ounce of sugar.

Wash the linseed well and place all the ingredients except the lemon into a clean saucepan and allow to simmer for 1 hour. Add the lemon juice and strain.

Beef Tea.

1 lb. of lean beef.
1 pint of cold water.
$\frac{1}{2}$ teaspoonful of salt.

Having removed all the fat, chop or mince the lean meat finely. Place it in a jar with cold water and salt, cover the jar and stand it in a saucepan of hot water. Cook slowly for 4 or 5 hours.

Another method is to stand the jar in a slow oven and cook for 4 or 5 hours.

Strain the beef tea and remove any fat from the top.

Raw Meat Juice.

½ lb. of lean beef.
½ pint of cold water.
½ teaspoonful of salt or 3 minims of hydrochloric acid.

Having removed all the fat, chop or mince the lean meat finely. Place it in a basin with the cold water and salt or hydrochloric acid, cover and let it stand for 1 or 2 hours. Then press it through a fine strainer, or squeeze it through muslin, and remove any fat from the top.

N.B.—Cold water should be used to make beef tea and raw meat juice, as it softens the muscular fibres and extracts the juices.

Egg Flip.

1 egg.
¼ pint of milk.
1 wineglassful of brandy or sherry.
1 small tablespoonful of sugar.

Separate the yolk from the white of the egg. Place the yolk in a basin and the white on a plate. Add the sugar to the yolk and beat well together until the sugar is quite dissolved. Stir in the milk and brandy or sherry.

Add a very little salt to the white of egg and beat up well until light and frothy. Stir this in with the rest of the ingredients and serve in a tumbler.

Brandy Mixture.

2 ounces of cinnamon water.
2 ounces of brandy.
The yolk of 1 egg.
¼ ounce of sugar.

Beat up the yolk of egg and the sugar in a basin until the latter is quite dissolved. Stir in the cinnamon water and brandy.

Milk Jelly.

1 pint of milk.
¾ ounce of gelatin.
1 ounce of sugar.
1 teaspoonful of brandy.

Place the milk, gelatin, and sugar in a small clean saucepan and stir over a low heat until dissolved. Add the brandy and pour through a fine strainer or muslin. When cool, pour into a mould rinsed in cold water and put in a cold place to set.

N.B.—Care must be taken not to make the milk hotter than necessary, or the gelatin will curdle it.

Egg Jelly.

2 lemons.
2 eggs.
6 ounces of sugar.
1 ounce of gelatin.
1 pint of cold water.

Wash the lemons and peel them very thinly, taking only the yellow part. Squeeze out the juice, put it into a measure, and make it up to 1 pint with cold water. Beat up the egg in a basin and add the lemon juice and water. Put all the ingredients into a small clean saucepan and stir over a low heat until the sugar and gelatin are dissolved and the jelly begins to thicken, but do not boil. Strain it, and put it into moulds to set.

Lemon Jelly.

2 or 3 lemons.
1 inch of cinnamon stick.
2 cloves.
6 ounces of lump sugar.
1 ounce of gelatin.
1 pint of cold water.

Wash and peel the lemons as before, squeeze out the juice, put it into a measure, and make it up to 1 pint with cold water. Put all the ingredients into a clean saucepan, and let it stand for a short time. Stir it over a low heat until dissolved. Strain it through a piece of muslin, and put it into moulds to set.

Port Wine Jelly.

5 ounces of port wine.
1 ounce of lump sugar.
½ ounce of gelatin.
½ inch of cinnamon stick.
2 cloves.
The rind and juice of half a lemon
¼ pint of cold water.

Wash and peel the lemon as before, squeeze out the juice and add it to the water. Place all the ingredients except the port wine into a saucepan, and warm until the gelatin is melted. Add the port wine, and strain through gauze. Put it into moulds, and leave it to set.

Cornflower Blanc Mange.

2 ounces of cornflour.
1 pint of milk.
1 ounce of sugar.
A small piece of butter ($\frac{1}{2}$ ounce).
Flavouring.

Put the cornflour into a basin and mix smoothly with a little of the milk. Put the rest of the milk on to boil. When boiling stir it on to the cornflour. Return it to the saucepan, add the sugar and butter, stir well, and boil for 3 minutes. Pour it into moulds which have been rinsed with cold water, and put it in a cool place to set.

Blanc Mange may be flavoured with lemon rind, cinnamon or bay leaf boiled in milk, essence of lemon or vanilla. These are stirred in at the last, just before pouring into the moulds.

Junket. (First method.)

1 pint of fresh milk.
1 tablespoonful of sugar.
1 junket tablet.
1 teaspoonful of cold water.
1 teaspoonful of brandy.

Put the milk and sugar into a saucepan and make them lukewarm. Add the brandy. Dissolve the junket tablet in a teaspoonful of water in a basin, and pour in the milk. Let it stand until set, and grate nutmeg on the top.

Junket. (Second method.)

1 pint of fresh milk.
1 tablespoonful of sugar.
2 teaspoonsful of essence of rennet.
1 teaspoonful of brandy.

Put the milk and sugar into a saucepan, and make them lukewarm. Add the brandy. Put these into a

basin, and add the essence of rennet. Let it stand until set, and grate nutmeg on the top.

Arrowroot.

2 teaspoonsful of arrowroot.
½ pint of milk.
A little salt or sugar.

Place the arrowroot in a basin, and mix smoothly with a little of the milk. Put the rest of the milk on to boil. When boiling stir on to the arrowroot. Return it to the saucepan, and stir well until it thickens. Serve in a hot cup with fingers of toast.

Benger's Food.

1 large tablespoonful of Benger's Food.
½ pint of milk.

Put the food into a basin, and mix smoothly with a little of the milk. Put the rest of the milk on to boil. When boiling stir on to the food, and allow it to stand for a short time. Put it into a saucepan, and stir well until boiling.

N.B.—The food must be mixed carefully to avoid lumps.

It may be boiled up straight away after adding the boiling milk, but by standing it becomes partly peptonised.

Gruel.

½ pint of milk.
1 dessertspoonful of fine oatmeal or patent groats.
A little salt or sugar.

Mix the oatmeal to a fine paste with a little of the cold milk. Put the rest of the milk on to boil. When boiling, pour it on to the oatmeal and return it to the saucepan, stir well and cook for 10 minutes. Add the salt, and serve in a hot cup.

Gruel may be made with half milk and half water. It should be well boiled.

Bread and Milk.

½ pint of milk.
Thin slice of bread.
½ teaspoonful of sugar.
Pinch of salt.

Remove the crust from the bread, and cut the crumb into small squares. Put into a hot basin or cup, and add the sugar and salt. Pour on the boiling milk and serve hot.

Toasted bread may be used.

Rice Pudding (without egg).

2 ounces of rice.
1 pint of milk.
½ ounce of butter.
1 ounce of sugar.
Pinch of salt.
Nutmeg or flavouring.

Put the rice, salt, and sugar into a buttered pie-dish, pour on the milk, add the nutmeg or flavouring, and bake slowly in a moderate oven for 1½ hours.

N.B.—Tinned milk or dried milk may be used if mixed with water. Less sugar should then be used.

Rice Pudding (with egg).

1 ounce of rice.
½ pint of milk.
½ ounce of sugar.
Pinch of salt.
1 egg.
Nutmeg or flavouring.

Put the rice into a small saucepan of boiling water with a little salt and boil till tender—about 10 minutes.

Strain it, and put it into a buttered pie-dish. Beat up the egg in a basin, add the sugar, milk and flavouring, pour it on to the rice in the pie-dish, and bake in a moderate oven until the custard is set and lightly browned—about 20 or 30 minutes.

N.B.—All milk puddings containing egg should be cooked slowly or they will become thin and watery.

Baked Custard Pudding.

2 eggs.
½ pint of milk.
½ ounce of sugar.
Nutmeg or flavouring.

Beat up the eggs in a basin, add the sugar, milk and flavouring, pour into a buttered pie-dish, and grate nutmeg on the top. Bake slowly in a moderate oven until the custard is set and lightly browned—about 20 or 30 minutes.

Boiled Custard.

2 eggs.
½ pint of milk.
½ ounce of sugar.
Flavouring.

Beat up the eggs in a basin, add the sugar and put the milk on to boil. When boiling stir it on to the eggs. Pour into a jug, and stand the jug in a saucepan of boiling water. Keep the custard well stirred till it thickens, like cream, taking great care not to overcook it. Pour into a basin, add a little flavouring, and stand aside till cold.

Sago Pudding.

1½ ounces of sago.
1 pint of milk.
1 ounce of sugar.
1 egg.
Nutmeg or flavouring.

Beat up the egg in a basin, and add the sugar. Put the milk in a saucepan with a strip of lemon rind and put on to boil. Sprinkle in the sago, stir and boil slowly till the sago becomes clear and transparent. Stir on to the beaten egg. Pour into a buttered pie-dish and cook in a moderate oven until set and lightly browned—about 20 or 30 minutes.

Bread and Butter Pudding.

1 or 2 thin slices of bread and butter.
1 egg.
½ ounce of sugar.
½ pint of milk.
Nutmeg or flavouring.

Remove the crust from the bread, cut it into small squares, and put into a pie-dish. Beat up the egg in a basin; add the sugar, milk, and flavouring, and pour

on to the bread and butter. Bake in a moderate oven until set and lightly browned—about 20 or 30 minutes.

Boiled Egg.

Put the egg into a small saucepan, cover with *cold* water and bring to the boil, when the egg will be lightly set.

Another method is to put the egg into a saucepan of *boiling* water and boil for 3 minutes.

Poached Egg.

1 egg.
½ teaspoonful of salt.
2 or 3 drops of lemon juice or vinegar.
Toast.

Put the water, salt, and lemon juice into a stewpan and bring to the boil. Break the egg carefully into the boiling water and simmer gently until the whole is set—about 1½ minutes. Serve on hot buttered toast.

N.B.—Eggs should be very lightly cooked for invalids.

Scrambled Eggs.

2 eggs.
2 slices of toast.
1 tablespoonful of milk.
½ ounce of butter.
Salt.

Beat up the eggs in a basin and add the salt and milk. Melt the butter in a small saucepan and pour in the eggs. Stir and cook slowly until the eggs are lightly set. Pile high on the toast.

Toast.

Cut the bread into thin slices. When toasted it should be evenly browned all over and well dried. Cut away the crust and stand the toast up in a rack to keep it crisp.

Raw Meat Pulp Sandwiches.

Lean meat.
Pepper and salt or fine castor sugar.
Slices of toast or thin bread and butter.

Take the fat from the meat, cut the meat into slices and scrape it finely with a knife. If possible rub the scraped meat through a wire sieve to finely pulverise it and remove any stringy pieces. Season it with salt and pepper or fine castor sugar (which disguises the flavour of the meat better), and spread on toast which has been split through and buttered, or on thin bread and butter. Make into sandwiches.

Chicken or Mutton Broth.

1 lb. of chicken or 1 lb. of neck of mutton—scrag end.
1 quart of cold water.
½ teaspoonful of salt.
1 ounce of pearl barley.
Small carrot, turnip and onion.

Remove the fat from the meat and cut both meat and bone into small pieces. Put into a saucepan with cold water and salt, and bring slowly to the boil. Take off the scum and add the vegetables (cut into small cubes) and the barley, which must be well washed. Simmer gently for 2 or 3 hours. When cooked, take out the bones, remove the fat, and add a teaspoonful of finely chopped parsley.

These broths are suitable for convalescent patients. If intended for the sick, strain out the meat and vegetables and omit the parsley.

Fish.

Fish may be divided into three classes :—

I. **White Fish.**—The flesh is light in colour, and all the oil is stored in the liver. It is the most suitable fish for invalids.
Examples :—Sole, Plaice, Whiting, Haddock (fresh).

II. **Oily Fish.**—The flesh is dark in colour, and the oil is interspersed between the flakes. It is more nourishing than white fish, but is not so digestible nor so wholesome for invalids.
Examples :—Herring, Mackerel, Salmon.

III. **Shell Fish.**—These are indigestible, unsafe, and not at all suitable for invalids, except Oysters which are almost self-digesting and very nourishing.

Boiled Fish.

Wash the fish, trim it and truss it into shape. Put it into a saucepan with sufficient hot water to cover it. Add 1 teaspoonful of salt and 1 teaspoonful of vinegar to the water and bring it to the boil. Then simmer gently for from 20 to 45 minutes, according to the size of the fish. When the skin cracks and the flesh turns white and opaque and shrinks from the bone it is a sign that it is sufficiently cooked. Serve on a hot dish with melted butter or egg sauce.

The average time required for boiling fish is 10 minutes for every pound and 10 minutes extra.

Steamed Fish.

Fillet the fish, season each fillet lightly with pepper and salt and fold in half with the skin inside. Put on to a lightly buttered plate and pour over it 2 or 3 tablespoonsful of milk. Cover it closely, stand the plate over a saucepan of boiling water and cook till the flesh turns white and opaque—about 20 minutes. When cooked serve on a hot dish. The liquid that has come from the fish should be poured over it.

Fried Fish.

1 plaice.
1 tablespoonful of flour.
1 egg.
Bread crumbs.
Pepper and salt.

Fillet the fish and dip each fillet into flour seasoned with pepper and salt. Then brush over with beaten egg and coat with bread crumbs. Fry in hot fat, drain on paper and serve hot.

The fat should be sufficiently hot before putting the fish in to cook. This will be seen by a bluish smoke rising from the fat.

Boiled Potatoes.

Wash and thinly peel the potatoes and put them into cold water to retain the colour. Put them into a saucepan with sufficient cold water to cover them and add half a tablespoonful of salt. Boil slowly until tender—about 20 or 30 minutes. Pour off all the water and put the pan back on the side of the stove. The potatoes are there steamed until white and floury. Serve piled high on a hot dish.

Mashed Potatoes.

After the potatoes are boiled and dried, break them up well and add a small piece of butter and a little milk. Beat well until quite smooth and creamy. Serve in a hot dish.

Fried Potatoes.

Peel the potatoes, remove the eyes, and put into cold water. Cut into very thin slices, dry on a cloth and fry in fat until lightly brown and crisp. Drain on paper. Sprinkle with salt and serve hot.

Boiled Cabbage.

Remove the outside leaves of the cabbage, cut across in four, and cut away the thick part of the stalk. Wash well in cold water and salt. Put it into a saucepan of fast-boiling water with half a tablespoonful of salt and a small piece of soda about the size of a pea. Boil quickly, without a lid on the saucepan, till the cabbage is tender —about $\frac{1}{2}$ hour. Strain it, press out all the water and serve piled lightly on a hot dish.

Steamed Chop.

Beat the chop and season it lightly with pepper and salt. Wrap it in buttered paper, put it on a plate and cover with a basin. Stand the plate over a saucepan of boiling water and cook for from 30 to 40 minutes according to the thickness of the chop. Serve with the liquid that has come from it.

Grilled Chop.

Beat the chop, trim off some of the fat, and season lightly with pepper and salt. See that the grill is thoroughly hot. Very quickly brown the underside and then turn it over and quickly brown the other side.

Then cook slowly, turning it every 2 or 3 minutes and taking care not to pierce the meat. Cook for from 10 to 15 minutes according to the thickness of the chop, Serve on a hot dish with a small piece of butter on the chop.

Minced Beef.

½ lb. of lean beef.
1 small onion (chopped finely).
1 teaspoonful of flour.
½ ounce of butter or dripping.
¼ pint of stock or water.
1 clove.
Pepper and salt.

Remove the fat from the beef and cut into small cubes. Melt the butter or dripping in a small saucepan, put in the chopped onion and quickly and lightly brown it. Put in the meat and brown it quickly. Stir in the flour, add the stock or water, season, and stir till it comes to the boil. Then simmer very gently for an hour. Remove any surface fat and serve on a hot dish with sippets of toast or mashed potato around.

Meat Panada.

½ lb. of chicken or lean meat.
The yolk of 2 eggs.
1 tablespoonful of stock.
Pepper and salt.

Take the fat from the meat and scrape it finely. Season it, add the yolk of egg, and the stock if not sufficiently moist. Rub through a sieve and make into small egg-shaped masses. Put into a buttered frying-pan, put on the stove and just cover with boiling water. Add a little salt and put a buttered paper on top. Simmer very gently for 10 minutes, drain, and serve on toast with a little beef tea poured round.

Roast Meat.

Weigh the meat and allow time for cooking as follows:—

Beef and Mutton, 15 minutes for every pound and 15 minutes extra.

Lamb and Veal, 20 minutes for every pound and 20 minutes extra.

Pork, 25 minutes for every pound and 25 minutes extra.

To roast meat, expose it to a good heat at first to seal up the outside and keep in the juice, then cook it more slowly to make it tender. Baste the meat well while cooking to prevent it getting dry and hard. If the meat is lean, additional fat must be added for this purpose.

Chicken requires from 45 to 60 minutes to roast, according to the size and age of the bird.

Boiled Meat (fresh).

Weigh the meat and allow 15 minutes for every pound and 15 minutes extra. Place the meat in fast-boiling water to seal up the outside, thereby keeping in the juice. Boil quickly for the first 5 minutes, then simmer gently till cooked to make the meat tender. Add one teaspoonful of salt to each gallon of water. To improve the flavour, add vegetables (carrots, turnips, and onions) to the water while the meat is boiling.

Boiled Salt Beef.

If the meat is very salt, soak it for some hours or overnight before it is cooked to extract the salt. Place in cold water and bring slowly to the boil. Allow 20 minutes for every pound and 20 minutes extra. After the water has come to the boil, simmer very gently to make the meat tender. Add vegetables to the water as before.

Bread Sauce.

4 tablespoonsful of bread crumbs.
1 small onion.
2 cloves.
½ pint of milk.
Pepper and salt.

Peel the onion, stick the cloves into it and put it into a clean small saucepan with the milk. Bring it to the boil and then pour it into a basin containing the bread crumbs. Cover the basin and stand it over a saucepan of boiling water for ¼ hour. Then take out the onion

and cloves and season the sauce with pepper and salt, stir in a small piece of butter and serve in a sauce-boat.

Parsley Sauce.

1 ounce of butter.
¾ ounce of flour.
½ pint of milk or milk and water.
1 teaspoonful of finely-chopped parsley.
Salt.

Melt the butter in a clean small saucepan and stir in the flour smoothly. Add the milk and stir well until it boils. Boil slowly for 3 minutes, season with salt and add the chopped parsley.

Egg Sauce.

1 ounce of butter.
¾ ounce of flour.
½ pint of milk or milk and water.
1 hard boiled egg (boil for ¼ hour).
Salt.

Melt the butter in a clean saucepan and stir in the flour smoothly. Add the milk and stir well until it boils. Boil for 3 minutes, season and add the egg cut into small cubes.

Sauce for Boiled Fish.

1 ounce of butter.
¾ ounce of flour.
½ pint of milk or milk and water.
Salt and pepper.

Melt the butter in a small saucepan and stir in the flour smoothly. Add the milk and stir well until it boils. Boil for 2 minutes and season with salt and pepper.

Chapter XXII.

ANÆSTHETICS.

Anæsthesia means the absence of feeling or sensation. The drugs producing this effect are called Anæsthetics, and are divided into two classes, Local and General.

1. LOCAL ANÆSTHETICS are those which produce anæsthesia only in the part to which they are applied.

(1) Cocaine is used in solution, the strength of which may be from $\frac{1}{2}$ to 10 per cent. It is applied directly to the conjunctiva or to mucous membrane, or is injected under the skin. It is liable to cause syncope.

(2) Eucaine resembles Cocaine and is used in the same way, but is not used in eye work. It is safer than cocaine. The usual strength is a 2 per cent. solution. It is often combined with Adrenalin, which checks bleeding.

(3) Novocaine
(4) Stovaine
(5) Tropacocaine
} These are similar to Cocaine, both in composition and in the method of administration.

(6) Ethyl Chloride is a clear liquid which is sprayed on to the skin, where it immediately evaporates and produces cold sufficient to freeze the part,

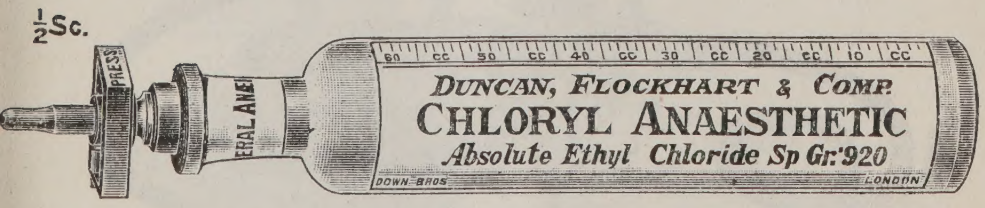


Fig. 194.
Ethyl Chloride Flask.

which turns white. It is supplied in glass flasks with a fine opening at one end protected by a spring cap. The spring is pressed, the flask inverted, and held from about 6 to

10 inches above the skin, from which all grease must be removed by washing with soap and water and then with ether. The subsequent thawing of the skin is painful.

2. GENERAL ANÆSTHETICS are those which produce unconsciousness and anæsthesia of the whole body, by acting on the brain.

(1) NITROUS OXIDE, commonly called "laughing gas," is supplied compressed in metal cylinders.

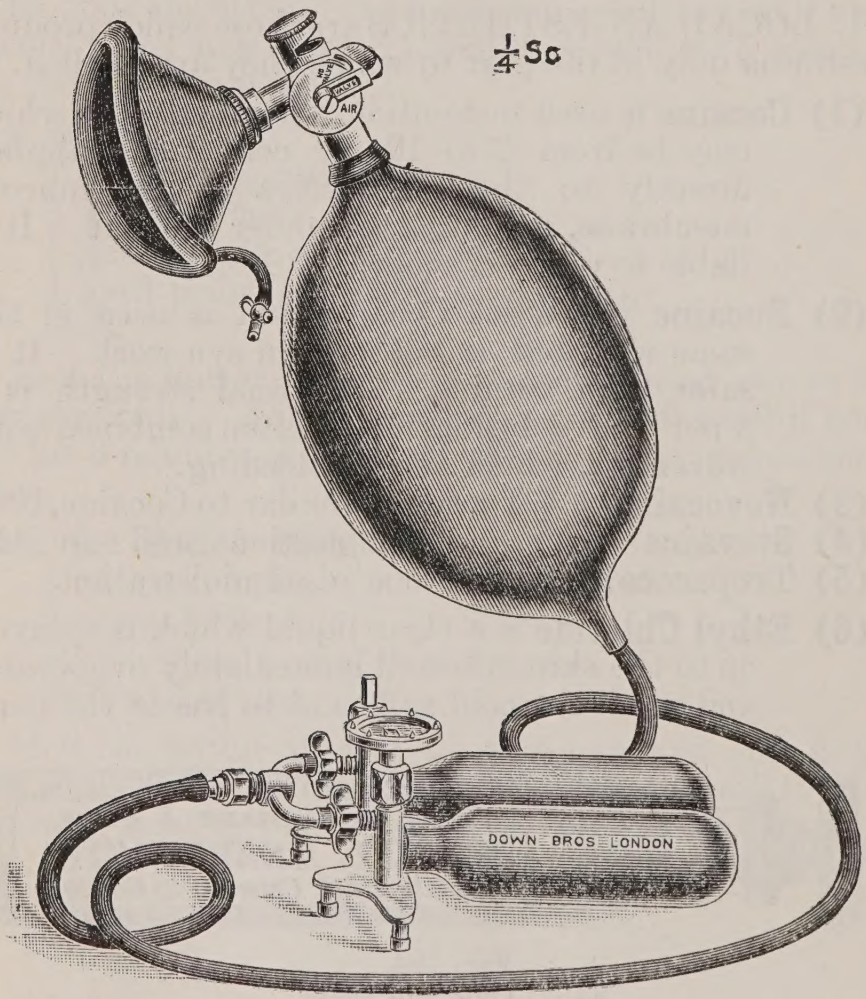


Fig. 195.

Nitrous Oxide Gas Apparatus.

The apparatus consists of a piece of rubber tubing leading from the cylinder to a large rubber bag, to which is attached a face piece.

As anæsthesia lasts for only 30 or 40 seconds after the face piece is removed, Nitrous Oxide is used for extracting teeth, and other short operations. It is also used as a preliminary to the administration of Ether. It is the safest general anæsthetic, produces no bad after-effects, and requires no special preparation of the patient beyond allowing no food for two hours previous to the operation.

(2) ETHYL CHLORIDE is used as a general, as well as a local, anæsthetic, the liquid being sprayed into a bag attached to a face piece. The anæsthesia lasts rather longer than with Nitrous Oxide, but it is not so safe.

(3) ETHER is the safest anæsthetic for long operations, and is given by a Clover's Inhaler. This consists of a metal chamber which contains the

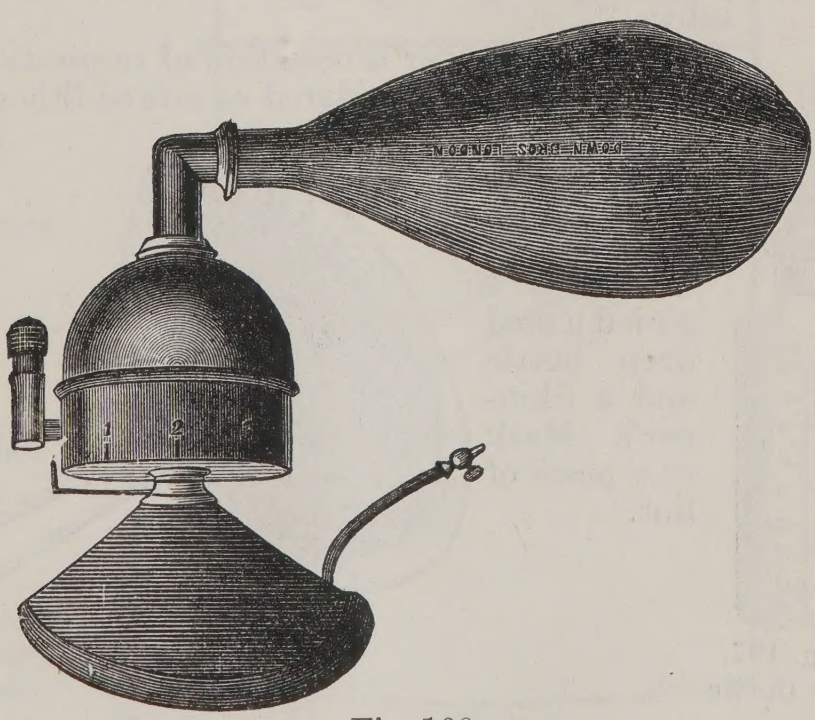


Fig. 196.
Clover's Inhaler.

ether, a rubber or cloth bag, and a face piece with a pneumatic pad. A measureful (= 2 ounces) of Ether is poured into the

chamber and the plug replaced. The proportion of air and Ether given can be regulated by revolving the chamber, on which are the marks 0 1 2 3 F. When the indicator points to 0, the patient is receiving air only; to 1, he is receiving 1 part of Ether and 3 of air; to 2, equal parts of Ether and air; to 3, 3 parts of Ether and 1 of air; to F, Ether alone.

Ether is also given by the "open method," the anæsthetic being dropped on to a mask.

As Ether has an unpleasant smell, irritates the lungs, and produces coughing, the patient is usually anæsthetised with Nitrous Oxide which is then replaced by the Ether.

The Signs of complete Anæsthesia are:— Pupils slightly dilated, corneæ insensitive, muscles relaxed, breathing deep, face pinkish in colour. There is often an increased flow of saliva.

The great danger is cessation of respiration.

(4) CHLOROFORM is not considered so safe as Ether as it depresses the heart. The only apparatus needed is a graduated drop bottle and a Skinner's Mask or a piece of lint.

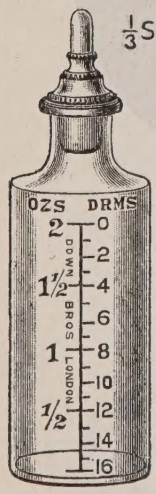


Fig. 197.
Drop Bottle.

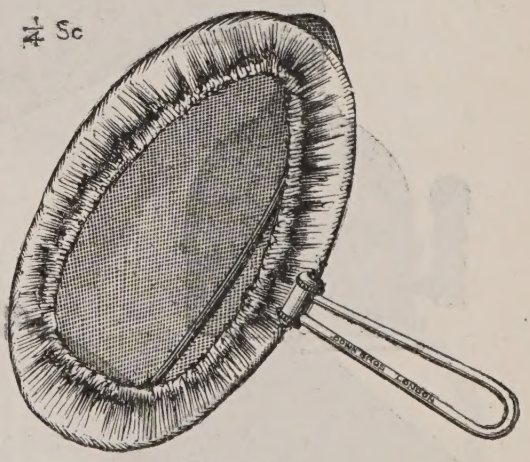


Fig. 198.
Skinner's Mask.

For operations about the face, a Junker's Inhaler is used, by which Chloroform vapour is pumped into the nose or mouth. The apparatus consists of a bottle to contain the Chloroform, to which are attached two rubber

tubes, one ending in a ball pump, the other in a metal tube which is held in the nose or mouth.

The Signs of complete Anæsthesia are :— Pupils contracted, corneæ insensitive, muscles relaxed, breathing quiet, face pale. The great danger is heart failure.

(5) Mixtures of Chloroform and Ether. Of these there are several forms, the commonest being :—

(*a*) **C.E. Mixture,** consisting of Chloroform 1 part, Ether 2 parts.

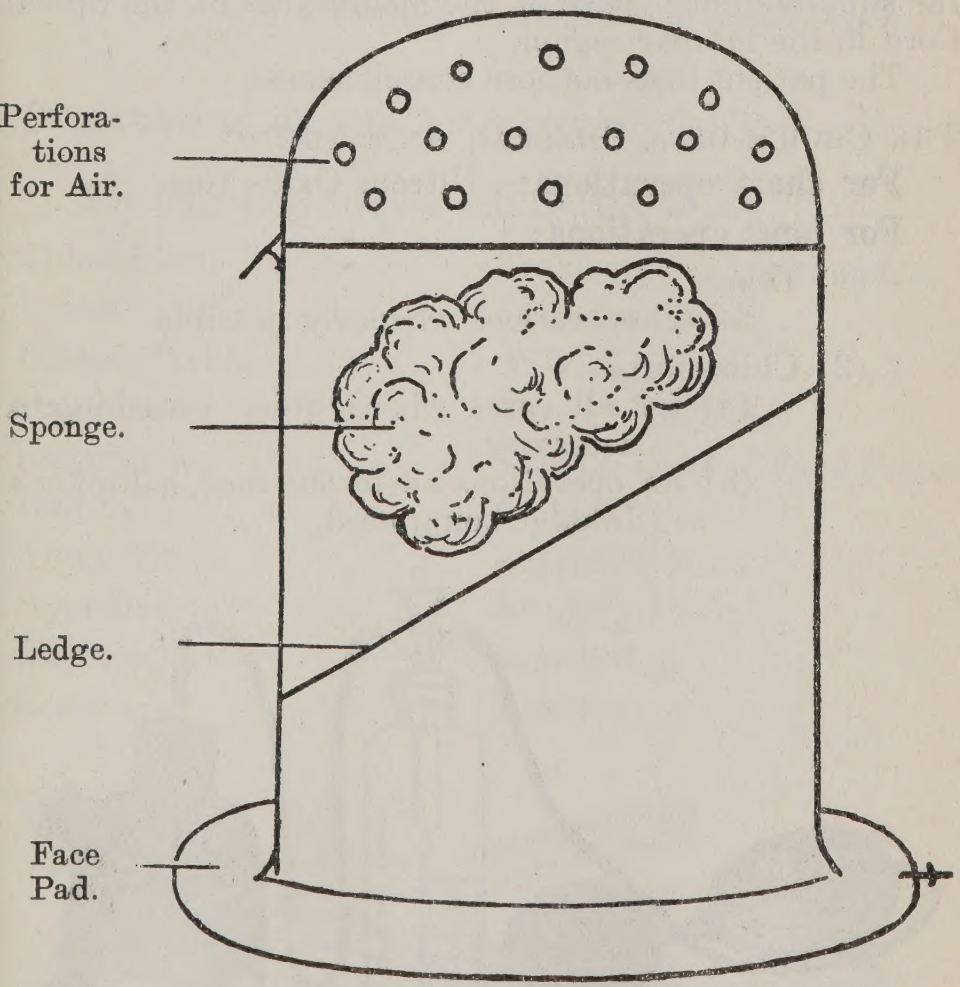


Fig. 199.—Rendle's Mask.
The ledge prevents the anæsthetic running down on to the patient's face.

(*b*) **A.C.E. Mixture,** consisting of Alcohol 1 part, Chloroform 2 parts, Ether 3 parts.

These are usually given in a Rendle's Mask, which consists of a perforated metal or celluloid cone containing a piece of sponge in the upper end.

The Signs are those of Chloroform Anæsthesia.

Spinal Anæsthesia.

Painless operations can be performed on the lower part of the body by injecting Stovaine or Novocaine into the sub-arachnoid space of the membranes of the Spinal Cord in the lumbar region.

The patient does not lose consciousness.

The Choice of a General Anæsthetic.

For short operations:—Nitrous Oxide Gas.

For long operations:—

(1) Ether
for all operations whenever possible.

(2) Chloroform
(*a*) for all cases where quiet breathing is necessary.
(*b*) for operations about the face, a Junker's Inhaler being used.

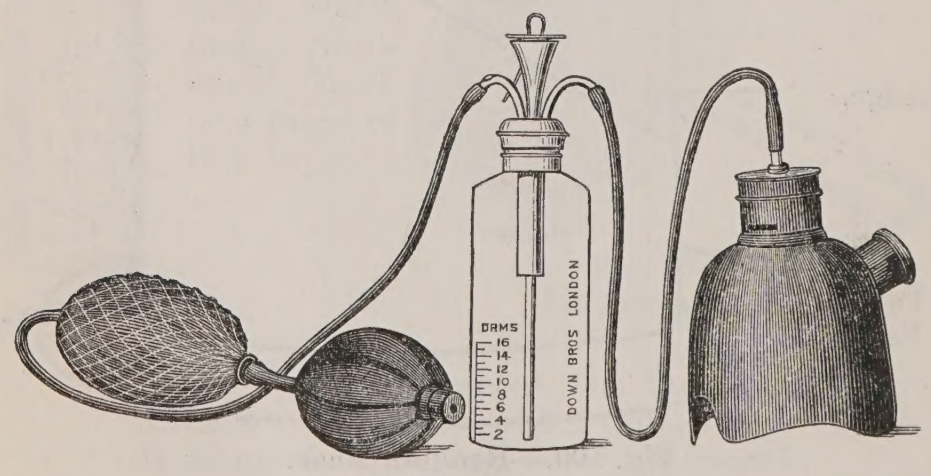


Fig. 200.
Junker's Inhaler.

(*c*) for cases where an open light is used which might set fire to Ether.

(*d*) for cases where there is any disease of the lungs.

(3) A.C.E. and C.E. Mixtures :—

(*a*) for very young or very old patients.

(*b*) for cases where there is any disease of the heart.

(*c*) for cases where there is much shock.

PREPARATION OF THE ANÆSTHETIC TABLE :—

The following articles will be required—

Chloroform.
Ether.
Nitrous Oxide.
Oxygen.
Strychnine.
Brandy.
Amyl Nitrite.
Hypodermic Syringe.
Electric Battery.
Receivers.
Tracheotomy Instruments.
Stethoscope.
A Watch.
Clover's Inhaler.
Various sizes of Face Pieces
Drop Bottles.
Skinner's Mask.
Rendle's Mask.
Mouth Gag.
Mouth Props.

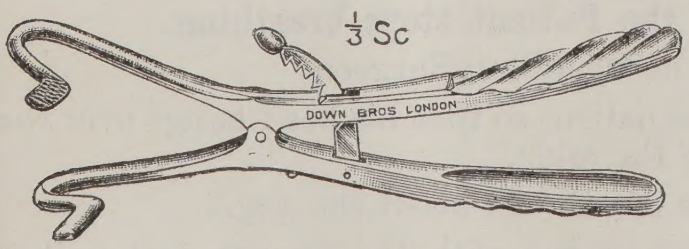


Fig. 201.
Mouth Gag.

Fig. 202.
Mouth Prop.

Tongue Forceps.
Sponge Forceps.
Swabs or Sponges.
Squares of Lint.
Strips of Gauze.
Towels.

The Transfusion Apparatus should always be at hand.

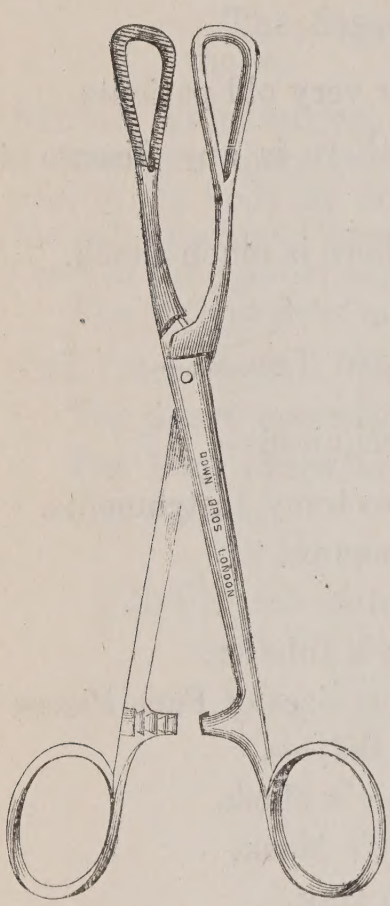


Fig. 203.
Tongue Forceps.

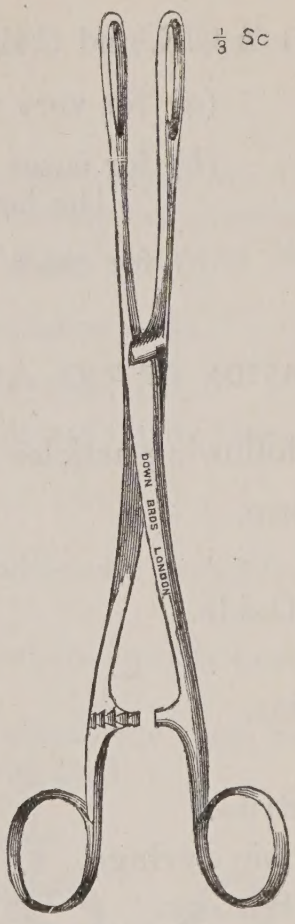


Fig. 204.
Sponge Forceps.

What to do if the Patient stops breathing.

(1) Inform the Operating Surgeon.

(2) Place the patient so that his head hangs over the end of the table.

(3) Open the mouth and insert the gag.

(4) Grasp the tongue with the forceps and pull it well forward.

(5) Clear the patient's mouth of mucus or vomit.

(6) Commence artificial respiration. Sylvester's Method is usually employed, augmented by compression of the lower ribs as in Howard's method. Expiration should first be caused by compressing the chest, to get rid of the poisonous gas which is still in the lungs.

(7) If the Operator does not object, fresh air may be admitted into the room.

If syncope occurs, a hypodermic injection of Strychnine (m5 — 10) or Ether (m20) is given, hot flannels applied over the heart, and a capsule of Amyl Nitrite crushed in a towel and held over the nose. The electric battery is also sometimes used.

Chapter XXIII.

A LIST OF MEDICINES PROVIDED IN CHESTS FOR USE IN HIS MAJESTY'S SHIPS.

N.B.—The term R.A. is an abbreviation of "Repeated Administration," and indicates the dose of a medicine when given several times during the day.

The term S.A. is an abbreviation of "Single Administration," and indicates the dose of a medicine when given once, without any intention of repeating it for a long period.

Latin Name.	English Name.	British Pharmacopœia Dose.	Chief Uses.
Acaciæ Gummi Pulvis.	Powdered Gum Acacia or Gum Arabic.	—	To prepare mucilage and suspend oils and insoluble powders.
Acidum Aceticum Glaciale.	Glacial Acetic Acid.	—	To burn off corns and warts.
Acidum Boricum	Boric or Boracic Acid.	5–15 grains.	Antiseptic, internally and externally.
Acidum Carbolicum Liquefactum.	Liquefied Carbolic Acid or Phenol.	1–3 minims.	Antiseptic and disinfectant.
Acidum Hydrochloricum.	Hydrochloric Acid.	—	To prepare diluted hydrochloric acid.
Acidum Hydrochloricum Dilutum.	Diluted Hydrochloric Acid.	5–20 minims.	To increase appetite for food and aid digestion.
Acidum Hydrocyanicum Dilutum.	Diluted Hydrocyanic Acid or Prussic Acid.	2–5 minims.	A sedative, especially to allay vomiting of food.
Acidum Nitricum	Nitric Acid	—	To prepare diluted nitric acid and in urine examination, also to burn off corns and warts.
Acidum Nitricum Dilutum.	Diluted Nitric Acid.	5–20 minims.	Stomachic tonic.
Acidum Sulphuricum.	Sulphuric Acid	—	To prepare diluted sulphuric acid.
Acidum Sulphuricum Dilutum.	Diluted Sulphuric Acid.	5–20 minims.	Tonic, astringent, used in treatment of lead-poisoning.

Latin Name.	English Name.	British Pharmacopœia Dose.	Chief Uses.
Acidum Tannicum.	Tannic Acid or Tannin.	5–10 grains.	Astringent in diarrhœa and dysentery and to sore throat.
Acidum Tartaricum.	Tartaric Acid -	5–20 grains.	To allay thirst, and in preparing Seidlitz Powders.
Adeps Lanæ Hydrosus.	Hydrous Wool Fat or Lanoline.	—	A basis for ointments.
Aether Purificatus	Purified Ether -	15–30 minims R.A. 45-60 minims, S.A.	Local and general anæsthetic and internally as a stimulant.
Alumen Purificatum.	Purified Alum -	5–10 grains.	Astringent internally and styptic externally.
Ammonii Carbonas.	Carbonate of Ammonia.	3–10 grains.	Stimulant and expectorant.
Ammonii Chloridum.	Chloride of Ammonia.	5–20 grains.	Stimulating expectorant and liver stimulant.
Amyl Nitris -	Nitrite of Amyl	2–5 minims inhaled.	Restorative after chloroform anæsthesia and antidote in Strychnine poisoning.
Amyli Pulvis -	Powdered Starch	—	Dusting powder and in preparing Mucilage.
Antimonium Tartaratum.	Tartarated Antimony or Tartar Emetic.	$\frac{1}{25}$–$\frac{1}{8}$ grain,	Diaphoretic.
		$\frac{1}{2}$–1 grains.	Emetic.
Argenti Nitras -	Nitrate of Silver or Lunar Caustic.	$\frac{1}{4}$–$\frac{1}{2}$ grain.	In nervous diseases and externally as a caustic and to stimulate ulcers, &c.
Bismuthi Carbonas.	Carbonate of Bismuth.	5-20 grains.	To allay vomiting and diarrhœa.
Caffeinæ Citras -	Citrate of Caffein	2–10 grains.	Heart stimulant and in treatment of headache.
Calx Sulphurata -	Sulphurated Lime.	$\frac{1}{4}$–1 grain.	In treatment of boils and small abscesses.

Latin Name.	English Name.	British Pharmacopœia Dose.	Chief Uses
Camphora - -	Camphor - -	2–5 grains.	Sedative and diaphoretic.
———	Carlsbad Salts -	60 grains.	Aperient and liver stimulant.
Chloral Hydras -	Hydrate of Chloral.	5–20 grains.	In treatment of sea-sickness and as a hypnotic.
———	Chlorodyne -	5–20 minims.	Sedative and in treatment of diarrhœa and coughs.
Chloroformum -	Chloroform -	1–5 minims.	General anæsthetic, sedative and a preservative.
Cocainæ Hydrochloridum.	Hydrochloride of Cocaine.	$\frac{1}{10}$–$\frac{1}{4}$ grain.	Local anæsthetic and in treatment of sea-sickness.
Collodium Flexile	Flexible Collodion.	—	To form an artificial skin over cuts and incisions.
Copaiba - -	Copaiba	30–60 minims.	In gonorrhœa as diuretic and antiseptic.
Cremor Mercurialis.	Mercurial Cream	—	By intra-muscular injection in syphilis. Contains 1 grain of mercury in 5 minims.
Creosotum - -	Creosote - -	1–5 minims.	Internally, antiseptic. Inhaled in Bronchitis.
Creta Aromatica cum Opio.	Aromatic Chalk with opium.	10–60 grains.	Astringent in diarrhœa.
Cupri Sulphas -	Copper Sulphate, Blue Stone, or Blue Vitriol.	$\frac{1}{4}$–2 grains.	Astringent.
		5–10 grains.	Emetic.
Emplastrum Belladonnæ Sparsum.	Spread Belladonna Plaster.	—	Adheres to the skin. Allays rheumatic pain, lumbago, &c.
Extractum Belladonnæ.	Extract of Belladonna or Deadly Nightshade.	$\frac{1}{4}$–1 grains.	To check secretions and incontinence of urine, Externally, to allay pain.
Extractum Cascaræ Sagradæ Siccum.	Dry Extract of Cascara Sagrada.	2–8 grains.	Tonic-aperient.
Extractum Ergotæ.	Extract of Ergot	2–8 grains.	To check internal bleeding and night-sweats.
Extractum Filicis Liquidum.	Liquid Extract of Male Fern.	45–90 minims.	Anthelmintic for tapeworm.

Latin Name.	English Name.	British Pharmacopœia Dose.	Chief Uses.
Ferri et Quininæ Citras.	Citrate of Quinine and Iron.	5–10 grains.	Bitter tonic and astringent.
Ferri Sulphas Exsiccatus.	Dried Sulphate of Iron.	½–3 grains.	Astringent and blood tonic.
Glycerinum -	Glycerine - -	1–2 drams.	As a rectal injection in constipation, to allay cough, and as a sweetening agent.
Hexamina - -	Hexamethylene-tetramine.	5–15 grains.	In bladder complaints, especially cystitis.
Hydrargyri Subchloridum.	Subchloride of Mercury or Calomel.	½–5 grains.	Purgative. Externally in skin diseases.
Hydrargyri Perchloridum.	Perchloride of Mercury or Corrosive Sublimate.	$\frac{1}{32}$–$\frac{1}{16}$ grain.	Antiseptic, and in treatment of syphilis. Externally antiseptic.
Hydrargyrum cum Creta.	Mercury with chalk, or Grey Powder.	1–5 grains.	Aperient for children and in mercurial treatment of syphilis.
Iodoformi Pulvis	Powdered Iodoform.	½–3 grains.	Internally (seldom used) to reduce glandular enlargements. Externally antiseptic.
Ipecacuanhæ Pulvis.	Powdered Ipecacuanha.	½–2 grains, 15–30 grains.	Expectorant and diaphoretic. Emetic.
Ipecacuanha cum Opio.	Ipecacuanha with Opium, or Compound Ipecacuanha Powder.	5–15 grains.	Diaphoretic
Jalapæ Pulvis -	Powdered Jalap	5–20 grains.	Purgative, useful in treatment of dropsy.
Linimentum Saponis.	Soap Liniment or Opodeldoc.	—	Rubbed into sprains and stiff joints.

Latin Name.	English Name.	British Pharmacopœia Dose.	Chief Uses.
Liquor Ammonii Acetatis Fortis.	Strong Solution of Ammonium Acetate.	—	In preparing solution of acetate of ammonia, B.P.
Liquor Ammonii Acetatis, B.P.	Solution of Ammonium Acetate.	2–6 drams.	Diaphoretic.
Liquor Ammonii Fortis.	Strong Solution of Ammonia.	—	In preparing liquor ammoniæ, B.P.
Liquor Ammoniæ, B.P.	Solution of Ammonia.	—	In preparing liniment of ammonia, and applied to the nostrils as a stimulant.
Liquor Arsenicalis.	Arsenical Solution, or Fowler's Solution.	2–8 minims.	Blood tonic, and in skin diseases.
Liquor Calcis Saccharatus.	Saccharated Solution of Lime.	15–60 minims.	Antacid, astringent and to allay vomiting.
Liquor Epispasticus.	Blistering Fluid	—	To raise blisters.
Liquor Ferri Perchloridi Fortis.	Strong Solution of Perchloride of Iron.	—	To prepare Tinctura Ferri Perchloridi, and externally as a styptic.
Liquor Formaldehydi.	Solution of Formaldehyde.	—	Disinfectant.
Liquor Morphinæ Hydrochloridi	Solution of Hydrochloride of Morphia.	10–60 minims.	Hypnotic and sedative
Liquor Potassæ	Solution of Potash.	10–30 minims well diluted.	Antacid and in preparing copaiba mixture.
Liquor Sennæ Concentratus.	Concentrated Solution of Senna.	30–60 minims.	Purgative.

Latin Name.	English Name.	British Pharmacopœia Dose.	Chief Uses.
Liquor Strychninæ Hydrochloridi.	Solution of Strychnine Hydrochloride.	2–8 minims.	Bitter tonic—heart and nerve stimulant, antidote in chloral and chloroform poisoning. *N.B.*—A powerful poison.
Magnesii Carbonas Ponderosus.	Heavy Carbonate of Magnesia.	5–20 grains, R.A. 30–60 grains, S.A.	Antacid and purgative.
Magnesii Sulphas	Sulphate of Magnesia or Epsom Salts.	30–90 grains, R.A. 120–240 grains. S.A.	Purgative, used in preparing black draught and white mixture.
Methylsulphonal	Trional - -	10–20 grains.	Hynoptic and sedative.
Oleum Crotonis -	Croton Oil -	½–1 minim.	Very powerful purgative.
Oleum Menthæ Piperitæ.	Oil of Peppermint.	½–3 minims.	To allay pain in the stomach; flavouring agent, and to overcome griping of purgatives.
Oleum Morrhuæ	Cod Liver Oil -	1–4 drams.	Nutritive tonic, especially in tuberculosis.
Oleum Olivæ -	Olive Oil - -	—	In doses up to 1 oz., as a laxative, often in the form of an enema. Externally, applied to burns.
Oleum Ricini -	Castor Oil -	1–8 drams.	Safe purgative.
Oleum Terebinthinæ Rectificatum.	Rectified Oil of Turpentine.	2–10 minims.	As a diuretic.
		3–4 drams.	As an anthelmintic in tape-worm. Inhaled in bronchitis.

Latin Name.	English Name.	British Pharmacopœia Dose.	Chief Uses.
Opii Pulvis -	Powdered Opium	½–2 grains.	Hypnotic and sedative.
Paraffinum Molle	Soft Paraffin -	—	Externally, emollient and a basis for ointments.
Pepsini, Bismuthi Carbonatis et Strychninæ Sulphatis Tabellæ.	Tablets of Pepsin, Bismuth and Strychnine.	1–5 tablets.	In treatment of indigestion.
Phenacetinum -	Phenacetine -	5–15 grains.	Antipyretic and nerve sedative.
Pilula Colocynthidis Composita.	Compound Colocynth Pill.	4–8 grains.	Purgative.
Pilula Colocynthidis et Hyoscyami.	Colocynth and Hyoscyamus Pill.	4–8 grains.	Purgative, the hyoscyamus allaying the griping.
Pilula Hydrargyri.	Mercury Pill or Blue Pill.	4–8 grains.	Purgative and liver stimulant.
Pilula Plumbi cum Opio.	Lead and Opium Pill.	2–4 grains.	Astringent in diarrhœa, dysentery and internal bleeding, the opium allaying the pain.
Pilula Rhei Composita.	Compound Rhubarb Pill.	4–8 grains.	Safe purgative.
Pilula Saponis Composita.	Compound Soap Pill.	2–4 grains.	Hypnotic and sedative. *Contains 20% of Opium.*
Plumbi Subacetas	Subacetate of Lead.	—	40 grains in one pint of water as a lotion to allay inflammation of sprains and bruises.
Podophylli et Hyoscyami Tabellæ.	Tablets of Podophyllum and Hyoscyamus.	1–4 tablets.	Purgative, stimulant to liver and intestines.
Potassii Acetas Granulata.	Granular Acetate of Potash.	15–60 grains.	Diuretic.
Potassii Bicarbonas.	Bicarbonate of Potash.	5–30 grains.	Antacid and diuretic and to render the urine alkaline.
Potassii Bromidum.	Bromide of Potash.	5–30 grains.	Sedative and hypnotic.
Potassii Chloras -	Chlorate of Potash.	5–15 grains.	As a gargle to sore throat and tender gums; internally to inflamed stomach.

Latin Name.	English Name.	British Pharmacopœia Dose.	Chief Uses.
Potassii Iodidum	Iodide of Potash	5–20 grains.	To reduce glandular swellings in treatment of syphilis and rheumatism.
Potassii Nitras -	Nitrate of Potash, Nitre, or Salt Petre.	5–20 grains.	Diuretic and diaphoretic.
Potassii Permanganas.	Permanganate of Potash.	1–3 grains.	Antiseptic and deodorizer.
Quininæ Bisulphas.	Bi-sulphate, or Acid Sulphate of Quinine.	1–10 grains.	In small doses, a bitter tonic ; in larger doses, antipyretic.
Salol - - -	Salol - -	5–20 grains.	Intestinal antiseptic, especially in typhoid fever.
Santoninum -	Santonine - -	1–3 grains.	Anthelmintic in round and thread worms.
Sodii Bicarbonas	Bicarbonate of Soda.	5–30 grains.	Antacid and gastric sedative.
———	Sodium Chloride Compound.	—	Two pellets in 1 pint of sterilized water forms normal saline solution.
Sodii Salicylas -	Salicylate of Soda.	10–30 grains.	In rheumatism and gout, and antipyretic in pneumonia, &c.
Spiritus Ætheris Nitrosi.	Spirit of Nitrous Ether, or Sweet Spirit of Nitre.	15–60 minims.	Diaphoretic, diuretic, antipyretic, and stimulant.
Spiritus Ammoniæ Aromaticus.	Aromatic Spirit of Ammonia, or Spirit of Sal Volatile.	20–40 minims R.A. 60–90 minims S.A.	Stimulant, also domestic remedy for headache.
Spiritus Methylatus.	Methylated Spirit of Wine.	—	For burning in lamps and in preparing evaporating lotions.
Spiritus Rectificatus.	Rectified Spirit, Spirit of Wine, or Alcohol.	—	In the form of brandy as a stimulant ; in preparing evaporating lotions and tinctures.

Latin Name.	English Name.	British Pharmacopœia Dose.	Chief Uses.
Sulphur Sublimatum.	Sublimed Sulphur. or Flowers of Sulphur.	20-60 grains.	Internally a mild aperient—externally, for skin diseases.
Syrupus Eastoni	Easton's Syrup, or Syrup of Phosphates of Iron, Quinine, and Strychnine.	30–60 minims.	Blood and nerve tonic.
Tinctura Aconiti	Tincture of Aconite, or Monkshood.	2–5 minims.	Anodyne, diaphoretic, and antipyretic. Externally to allay pain.
Tinctura Belladonnæ.	Tincture of Belladonna, or Deadly Nightshade.	5–15 minims.	The same as Ext. Belladon.
Tinctura Benzoini Composita.	Compound Tincture of Benzoin, or Friar's Balsam.	30–60 minims.	Expectorant and antiseptic, inhaled with steam in bronchitis. Externally, styptic and antiseptic.
Tinctura Camphoræ Composita.	Compound Tincture of Camphor, or Paregoric Elixir.	30–60 minims.	To allay cough.
Tinctura Catechu	Tincture of Catechu.	30–60 minims.	Astringent in diarrhœa and dysentery.
Tinctura Cinchonæ Composita.	Compound Tincture of Cinchona.	30–60 minims.	Bitter tonic, astringent, and to allay pain of neuralgia.
Tinctura Colchici	Tincture of Colchicum or Meadow Saffron.	5–15 minims.	In gout, to increase secretion of uric acid and other solids.
Tinctura Digitalis	Tincture of Digitalis, or Foxglove.	5–15 minims.	Valuable heart stimulant and diuretic.
Tinctura Gentianæ Composita.	Compound Tincture of Gentian.	30–60 minims.	Bitter tonic.

Latin Name.	English Name.	British Pharmacopœia Dose.	Chief Uses.
Tinctura Hyoscyami.	Tincture of Hyoscyamus, or Henbane.	30–60 minims.	Hypnotic, sedative, and diuretic, also to overcome griping of purgatives.
Tinctura Iodi Fortis.	Strong Tincture of Iodine.	—	Externally, counter irritant and antiseptic.
Tinctura Iodi Mitis.	Weak Tincture of Iodine.	2–5 minims.	Externally, antiseptic. Internally, to check vomiting.
Tinctura Nucis Vomicæ.	Tincture of Nux Vomica.	5–15 minims.	Bitter tonic and nerve stimulant.
Tinctura Opii	Tincture of Opium, or Laudanum.	5–15 minims. R.A. 20–30 minims. S.A.	Narcotic and sedative.
Tinctura Quassiæ	Tincture of Quassia.	30–60 minims.	Bitter tonic.
Tinctura Quininæ Ammoniata.	Ammoniated Tincture of Quinine.	30–60 minims.	Anti-pyretic in influenza and "cold in the head."
Tinctura Rhei Composita.	Compound Tincture of Rhubarb.	30–60 minims R.A. 2–4 drams S.A.	In small doses, stomachic tonic. In large doses, purgative and then astringent, therefore useful in diarrhœa.
Tinctura Scillæ	Tincture of Squill.	5–15 minims.	Stimulant, expectorant, diuretic, and heart tonic.
Tinctura Zingiberis.	Tincture of Ginger.	30–60 minims.	Aromatic stimulant, flavouring agent, and to overcome griping of purgatives.
Unguentum Gallæ cum Opio.	Gall and Opium Ointment.	—	Astringent to painful hæmorrhoids or piles.

Latin Name.	English Name.	British Pharmacopœia Dose.	Chief Uses.
Unguentum Hydrargyri.	Mercury Ointment or Blue Ointment.	—	To cause absorption of fluid in swellings, &c., in parasitic skin diseases, and in syphilis.
Unguentum Hydrargyri Nitratis.	Nitrate of Mercury Ointment.	—	Applied to ringworm; diluted in skin diseases.
Unguentum Hydrargyri Oxidi Flavi.	Yellow Oxide of Mercury Ointment.	—	In ringworm, skin disease, syphilitic eruptions, and "sore eyes."
Vinum Ipecacuanhæ.	Ipecacuanha Wine.	10–30 minims (expectorant). 4–6 drams (emetic).	Small doses, expectorant and diaphoretic. In large dose, emetic.
Zinci Oxidum -	Oxide of Zinc -	3–10 grains.	To check night sweats of phthisis, and tonic in nervous affections. Externally, dusting powder, and to sores and ulcers as Zinc Ointment.
Zinci Sulphas -	Sulphate of Zinc or White Vitriol.	1–3 grains (astringent). 10–30 grains (emetic).	In small doses, astringent and tonic. In large doses, emetic and astringent; injected for gonorrhœa.
Zinci Sulpho-carbolas.	Sulpho-carbolate of Zinc.	—	As an astringent and antiseptic injection for gonorrhœa.

The following drugs are provided in the form of small tablets. One or more tablets, according to the dose required, should be dissolved in from five to ten minims of **sterilised** water, and the solution injected under the skin. They are known as HYPODERMIC tablets, from two Greek words meaning "under the skin." The word SUBCUTANEOUS is derived from the Latin, and also means "under the skin":—

Drug.	Strength.	Use.
Apomorphinæ Hydrochloridum.	$\frac{1}{15}$ grain	Emetic.
Atropinæ Sulphas	$\frac{1}{150}$ „	To check "sweating" in phthisis.
Cocainæ Hydrochloridum	$\frac{1}{2}$ „	Local anæsthetic.
Digitalinum	$\frac{1}{100}$ „	Heart stimulant.
Ergotininæ Citras	$\frac{1}{200}$ „	To arrest bleeding.
Eserinæ Salicylas	$\frac{1}{100}$ „	In treatment of "lock-jaw."
Hyoscinæ Hydrobromidum.	$\frac{1}{200}$ „	As a sedative in "mania" and mental excitement.
Hydrargyri Perchloridum	$\frac{1}{60}$ „	In treatment of syphilis.
Morphinæ Sulphas	$\frac{1}{4}$ „	Sedative and hypnotic.
Morphinæ Sulphas cum Atrophinæ Sulphas	$\frac{1}{4}$ „ / $\frac{1}{150}$ „	Sedative and hypnotic, the Atropine overcoming the unpleasant after-effects of the Morphia.
Nitroglycerine	$\frac{1}{250}$ „	In asthma and difficulty of breathing.
Pilocarpinæ Nitras	$\frac{1}{10}$ „	Powerful diaphoretic.
Renalin	$\frac{1}{640}$ „	Local anæsthetic and hæmostatic.
Sodii Chloridum	$1\frac{1}{4}$ „	
Eucaine Lactate	$\frac{1}{3}$ „	
Strychninæ Sulphas	$\frac{1}{100}$ „	Powerful nerve stimulant and antidote to Chloral and Chloroform "poisoning."

The following OPHTHALMIC tablets are soluble in water. One or more placed on the eye dissolve in the fluid and produce the effect as shown :—

Drug.	Strength.	Use.
Atropinæ Sulphas - -	$\frac{1}{200}$ grain	To dilate the pupil.
Cocainæ Hydrochloridum	$\frac{1}{20}$ „	Local anæsthetic.
Eserinæ Salicylas - -	$\frac{1}{600}$ „	To contract the pupil, especially after the use of Atropine.
Homatropinæ Hydrochloridum.	$\frac{1}{40}$ „	To dilate the pupil—the dilatation disappearing more quickly than when Atropine is used.

WEIGHTS AND MEASURES USED IN COMPOUNDING MEDICINES.

Two Systems of weights are used in compounding medicines—the APOTHECARIES' and the AVOIRDUPOIS.

The former is almost invariably employed by medical men in writing prescriptions, and the latter is used in calculating large quantities of drugs for the preparation of "Stock" mixtures.

The lowest denomination in each system is the **grain,** which was originally a quantity of any substance equal in weight to a ripe grain of wheat.

It should be carefully borne in mind that the grain in the Avoirdupois System is exactly the same weight as the grain in the Apothecaries' System, but that all the other weights bearing the same name differ.

Avoirdupois Table.

These weights are usually made of brass in the shape as shown.

	Grain	- -	(gr.)
27·3	grains	= 1 dram	(dr.)
437·5	„	= 1 ounce	(oz.)
7000·0	„	= 1 pound	(lb.)

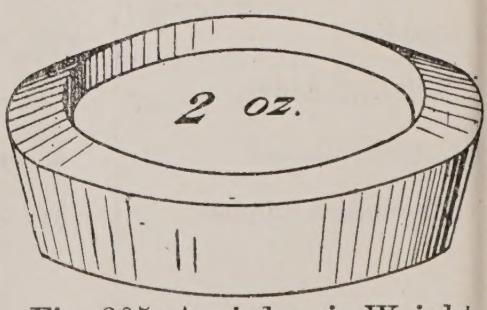
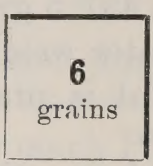


Fig. 205. Avoirdupois Weight.

Apothecaries' Table.

Grain	-	- abbreviated in prescriptions to			gr.
20 grains	= 1 scruple,	represented by the symbol			℈
60 „	= 1 dram,	„	„	„	ʒ
480 „	= 1 ounce,	„	„	„	℥

The weights of 6 grains and under are usually made of thin pieces of brass or aluminium stamped in plain figures, thus :—



The larger weights are of thicker brass, either round or square, and marked with the symbol thus :—

or

MEASURES.

The lowest denomination used in the Measures is the MINIM, derived from the Latin **minimum**, meaning the least. It is a quantity of any fluid equal to practically a drop of water. The standard from which the measures are calculated is the Imperial Gallon, a quantity of distilled water at 60° F. weighing 10 lbs. avoirdupois.

A Table of Measures.

Minim	-	- abbreviated in prescriptions to			m
60 minims	= 1 dram,	represented by the symbol			ʒ
8 drams	= 1 ounce,	„	„	„	℥
20 ounces	= 1 pint,	„	„	„	O

(the initial letter of the Latin word **Octarium**).

8 pints = 1 gallon, represented by the symbol C
(the initial letter of the Latin word **Congius**).

As the same symbol is used to represent a dram by weight and a dram by measure, it is taken as a general rule that solids are ordered by weight and liquids by measure.

The following facts should be committed to memory :—

(1) 1 gallon of water weighs 10 lbs., or 160 ozs., or 70,000 grains.

(2) An ounce of water by measure = 480 minims, and weighs 437·5 grains.

(3) One pint of water weighs 8,750 grains.

(4) A tablespoonful is practically a half-an-ounce by measure.

(5) A teaspoonful is practically a dram by measure.

THE PREPARATION OF PERCENTAGE SOLUTIONS.

Many drugs, especially such as Atropine, Cocaine, and Eserine, which are applied to the eye, are usually ordered to be made of a definite percentage strength in water.

In calculating the quantity of substance to be weighed, the following points must be remembered :—

(1) One ounce of water by measure weighs 437·5 grains.

(2) The term 5 per cent. means 5 grains of the substance dissolved in 95 grains of water, the total thereby being 100 grains.

The following examples will show the application of these points :—

1ST EXAMPLE.—How much Cocaine Hydrochloride is required to make 3 drams by measure of a 5 per cent. solution ?

First, find the weight of the quantity to be made—in this particular case, 3 drams.

1 ounce by measure of water weighs 437·5 grains.

Therefore $\frac{3}{8}$ ounce by measure of water weighs

$$\frac{437{\cdot}5 \times 3}{8} \text{ grains.}$$

Then, by simple proportion, the calculation is as follows:—

If 100 grains of solution require to contain 5 grains Cocaine,

1 grain of solution requires to contain $\frac{5}{100}$ grains Cocaine.

Therefore $\frac{437{\cdot}5 \times 3}{8}$ grains of solution require to contain $\frac{437{\cdot}5 \times 3 \times 5}{8 \times 100}$ or 8·2 grains.

This quantity is weighed out, dissolved in a little water, and made up to 3 drams by measure.

2ND EXAMPLE.—How much Potassium Permanganate is required to make 3 pints of 1 per cent. solution?

The weight of 3 pints of water is 3 × 8,750 grains.

By simple proportion:

If 100 grains of solution require 1 grain of Potassium Permanganate

1 grain of solution requires $\frac{1}{100}$ of Potassium Permanganate.

Therefore 3 × 8,750 grains of solution requires $\frac{1}{100} \times \frac{3 \times 8{,}750}{1}$ or 262·5 grains.

This quantity is weighed out, dissolved in about a pint of warm water, and, when cold, made up with water to 3 pints.

3RD EXAMPLE.—How much Protargol is required to make 12 ounces of a ½ per cent. solution?

The weight of 12 ounces of water is 12 × 437·5 grains.

By simple proportion:

If 100 grains of solution require ½ grain of Protargol

1 grain of solution requires $\frac{{\cdot}5}{100}$ grains of Protargol.

Therefore 12 × 437·5 grains of solution require $\frac{{\cdot}5 \times 12 \times 437{\cdot}5}{100}$, or 26·25 grains.

This quantity is weighed out, placed in about 10 ounces of water, allowed to sink through into solution, and the volume finally made up with water to 12 ounces.

THE PREPARATION OF ANTISEPTIC LOTIONS.

Many antiseptics, especially Mercuric Chloride, are used in such strengths as 1 in 1,000, or 1 in 5,000, &c.

The expression "1 in 1,000" means that 1 grain of the antiseptic is dissolved in sufficient fluid, usually water, to produce 1,000 grains altogether.

As Mercuric Chloride is used in large quantities in surgery, the following examples will show how the quantity should be calculated for the solution. The procedure for other substances soluble in water is exactly the same.

1ST EXAMPLE.—How much Mercuric Chloride is required to prepare 3 gallons of 1 in 2,000 lotion?

The weight of 1 gall. of water is 70,000 grains,
Therefore „ „ „ 3 „ „ „ „ 3 × 70,000, or 210,000 grains.

Divide this by the strength, *i.e.*, 2,000 :—

2,000)210,000

105.

105 grains of Mercuric Chloride are weighed out, dissolved in warm water, and made up to 3 gallons with cold distilled water.

N.B.—Whenever possible, distilled water should be used, as the solid mineral matter in "spring" water precipitates a portion of the Mercuric Chloride.

For convenience in the Service afloat, solution pellets, each containing 8·75 grains of Mercuric Chloride, are provided. One of these dissolved in water, and made up to 1 pint, will produce a solution of 1 in 1,000, which can be proved as follows :—

One pint of water weighs 8,750 grains; dividing this by 8·75 produces 1,000, thus showing that 1 grain is dissolved in every 1,000 grains of the solution.

2ND EXAMPLE.—How much Boric Acid is required to make 5 pints of 1 in 500 lotion?

1 pint of water weighs 8,750 grains.
Therefore 5 pints „ „ weigh 8,750 × 5,
or 43,750 grains.
Dividing this by the strength 500, produces 87·5.

5,00)437,50

87·5

87·5 grains of Boric Acid are weighed out, dissolved in warm water, and made up to 5 pints with water.

In order to distinguish the lotions largely used in surgery, it is customary in hospital practice to colour them as follows :—

Mercuric Chloride - - - - - blue
Carbolic Acid - - - - - - pink

Boric Acid solution being colourless.

THE PREPARATION OF CARBOLIC LOTION.

Carbolic Acid is generally used in surgery as a 1 in 20 solution. This means, strictly, that one grain of Crystalline Carbolic Acid should be dissolved in water, and made up to 20 grains.

Carbolic Acid, however, being supplied to the Service afloat as Liquefied Carbolic Acid, this method is not practicable, an alternative method being adopted by using the liquefied acid.

The Crystalline Acid is liquefied by taking 100 ounces of the former, and adding 10 ounces of distilled water to it.

EXAMPLES :—

(1) How much Carbolic Acid is required to prepare 4 pints of 1 in 20 Carbolic Lotion?

4 pints = 80 ounces.

If 20 ozs. of Lotion require 1 oz. of Acid.

1 oz. „ „ „ $\frac{1}{20}$

80 ozs. „ „ „ $\frac{1}{20} \times \frac{80}{1} = 4$ ozs.

(2) How much Carbolic Acid is required to prepare 3 gallons of 1 in 40 Carbolic Lotion?

3 gallons = 480 ounces.

If 40 ozs. of Lotion require 1 oz. of Acid.

1 oz. „ „ „ $\frac{1}{40}$

480 ozs. „ „ „ $\frac{1}{40} \times \frac{480}{1} = 12$ ozs.

NOTES ON COMPOUNDING.

1. Before attempting to dispense medicines, the prescription should be carefully read through.

2. All Salts of Ammonia, Potash, and Soda are soluble in water, and should be weighed out and dissolved before adding other medicines.

3. Any essential oils, such as Peppermint, Aniseed, &c., should be dissolved separately in any Spirit or Tincture, and added at the finish.

4. Heavy, insoluble drugs, such as Carbonate of Bismuth, should be suspended by adding to the mixture a mucilage or Glycerine, thus preventing the heavy substance settling to the bottom so quickly.

5. Acids and Alkalies, when mixed, decompose each other. They are known as **Incompatibles** for that reason. Other incompatibles in common use are :— Preparations of Iron and Salicylates; preparations of Iron and Tannic Acid; Calomel and Alkalies; Mercuric Chloride and Alkalies, &c.

6. In shaking a bottle of medicine, the cork should be carefully put in. It is a bad habit to place a finger over the bottle in place of the cork.

7. Preparations to be used externally must be invariably dispensed in **blue** bottles, and labelled with a **yellow** label. Medicines to be taken internally must invariably be dispensed in **white** glass bottles, and the directions written on a **green** label.

ABBREVIATIONS COMMONLY USED IN PRESCRIPTIONS.

Abbreviation.	Latin or Greek.	English.
℞	Recipe.	Take
m.	Misce.	Mix.
ft.	Fiat.	Make.
āā	Ana.	Of each.
q.s.	Quantum sufficit.	A sufficiency.
	Ad.	Up to.
c̄	Cum.	With.
no.	Numero.	In number.
p.r.n.	Pro re nata.	As required.
s.o.s.	Si opus sit.	If necessary.
rep.	Repetatur.	Let it be repeated.
ss. or ʃs	Semi or semis.	A half.
h.s.	Hora somni.	At bedtime.
o.m.	Omni mane.	Every morning.
o.n.	Omni nocte.	Every night.
a.c.	Ante cibos.	Before meals.
p.c.	Post cibos.	After meals.
stat.	Statim.	At once.
t.i.d	Ter in die.	Three times a day.
t.d.s.	Ter in die sumenda.	Let it be taken three times a day.
q.h.	Quartis horis.	Every four hours.
b.i.d.	Bis in die.	Twice a day.

Chapter XXIV.

POST-MORTEM EXAMINATION ROUTINE.

A post-mortem examination is performed to ascertain or verify the cause of death.

The body is laid on a table having a waste pipe to drain the surface.

Instruments and Appliances required:—

Knives.
Scissors.
Saw.
Bone forceps.
Chisel.
Dissecting forceps.
Coronet.
Large needles.
Mackintosh aprons.
Towels.
Sponges.
String.
Indiarubber gloves.
Paper and pencils.
Clean basins and gallipots for specimens.
Microscope slides.

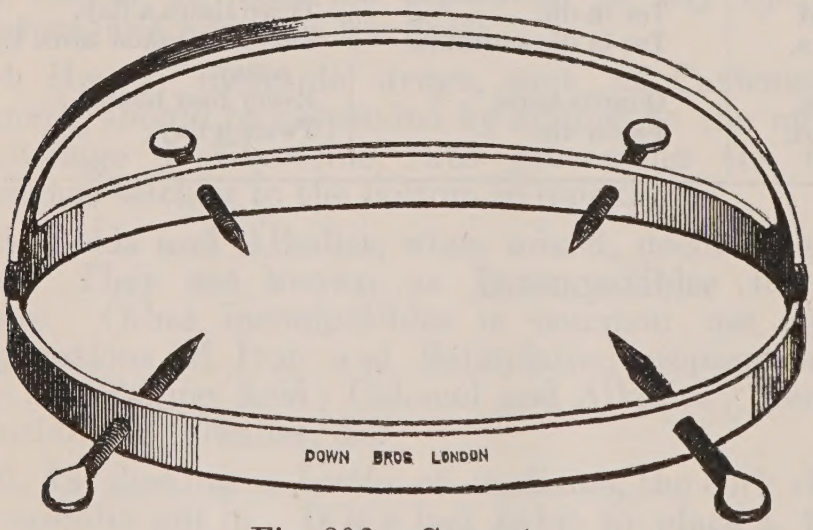


Fig. 206.—Coronet.

Routine.

The body is opened by an incision from the upper end of the sternum to the pubis. The skin, fat, and muscles are then separated from the front of the chest wall, and the thorax opened by cutting through the costal cartilages, and so removing the sternum.

After examining the organs in place, they are removed for more careful inspection. In removing the stomach and intestines, two ligatures are applied at either end, and the organ cut between them. This prevents the contents escaping at either end.

Each organ is usually weighed.

To remove the brain, the scalp is divided by an incision running over the vault from behind each ear. The scalp is then turned over the face and over the occiput, and the coronet fixed to the vault by the screws provided. The vault is then sawn through just below the coronet, and removed.

When the examination is completed, the various organs are returned. The sternum is placed in position, and fixed with string passed by a needle through the intercostal muscles. Similarly the skull cap is fixed by sewing the cut temporal muscles with string.

The edges of the cut skin are then drawn firmly together with a continuous string suture. The needle is first passed through both sides of the incision, the end of the string tied, and the knot turned in. Then the needle is passed first through one side and then the other, *always from within outwards*, and the string drawn tight after each stitch. The needle is held in one hand, and the string drawn tight with the other; the skin is thus steadied by the tension of the string, and there is less danger of pricking the finger. The suture is finished by tying the loose end to the last loop, and the knot tucked in.

The body must now be thoroughly washed, so that no trace of blood remains. If any oozing occurs from any orifice, such as the nostrils or anus, that orifice must be plugged with cotton wool. The body is then clothed in the grave clothes, and replaced in the coffin.

Post-mortem Wounds.

Those employed in making post-mortem examinations are liable to cut or prick themselves. As the dead body contains the germs of putrefaction, a very dangerous form of septic wound may result.

For treatment, *see* page 141.

Chapter XXV.

STRETCHERS.

The stretchers at present in use in the Service are :—

(1) **The Furley Stretcher,** consisting of a piece of brown canvas stretched between two stout

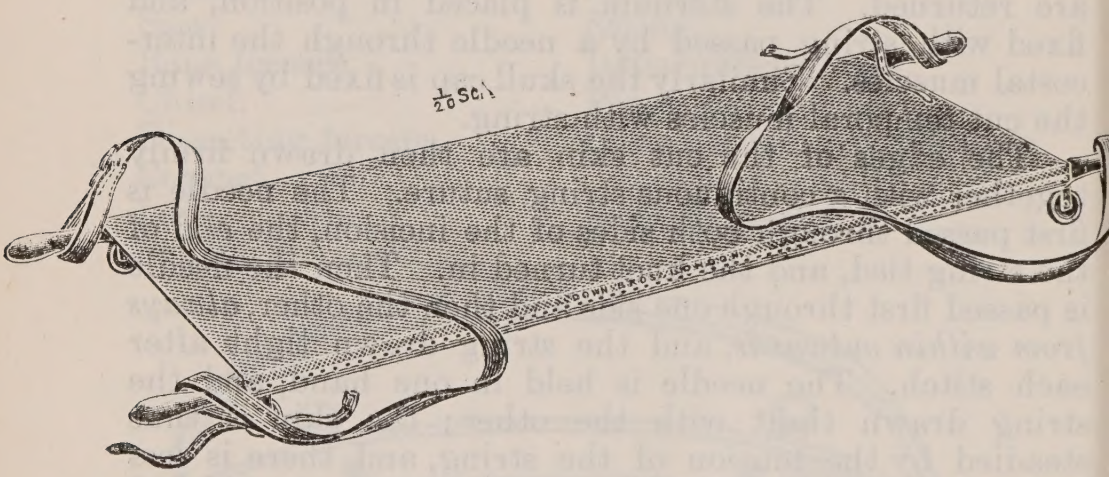


Fig. 207.

The Furley Stretcher.

poles which are kept apart by means of two hinged metal bars.

(2) **The Bamboo and Canvas Stretcher,** consisting of a piece of canvas the sides of which are sewn over to form loops through which long bamboo poles are inserted. These poles are kept apart by two rigid metal bars. This is a very light, simple, and efficient stretcher. (*See* Fig. 208, page 437.)

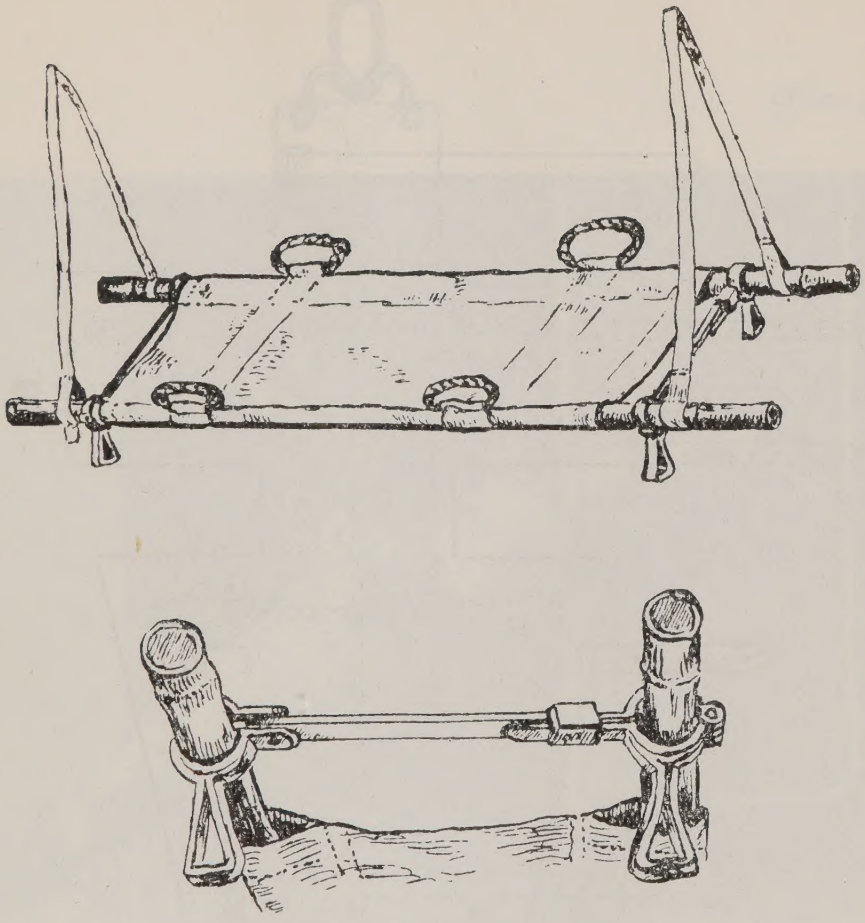


Fig. 208.

The Bamboo and Canvas Stretcher.

(First Aid in the Royal Navy.)

(3) **The Neil Robertson Hammock Stretcher,** which is made on the principle of Gooch's splinting, and practically surrounds the patient. It is made of bamboo and canvas, and its application is shown in the illustrations. Its advantages are : — lightness, strength, flexibility, compactness, and protection to the patient. It is specially useful in removing wounded men from such difficult places as turrets and stokeholds.

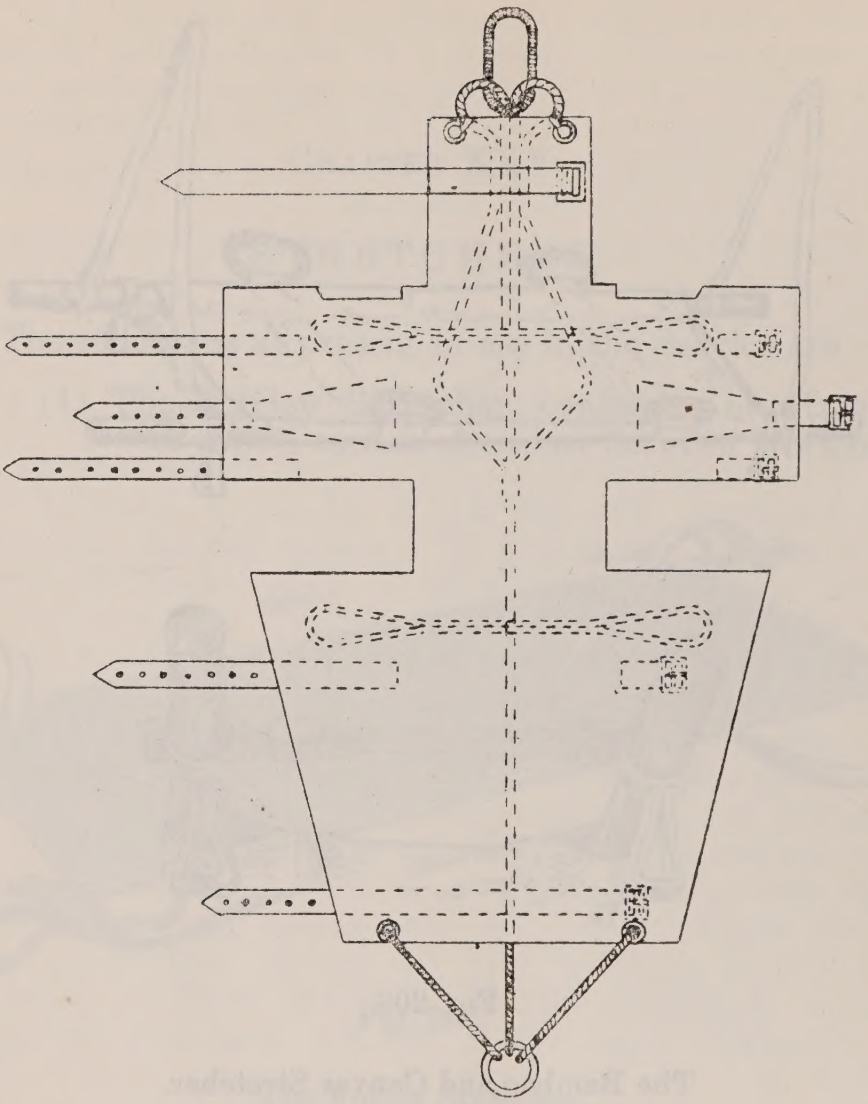


Fig. 209 (*a*).

The Neil Robertson Hammock Stretcher.

(First Aid in the Royal Navy.)

STRETCHER DRILL.

I. WITH FOUR BEARERS.

1. "Fall in" - The company fall in in two ranks facing the instructor.
2. "Right dress" The company dress by the right.
3. "Eyes front" The company face to the front.
4. "Number" - The company number from the right.

(*Face page* 438.)

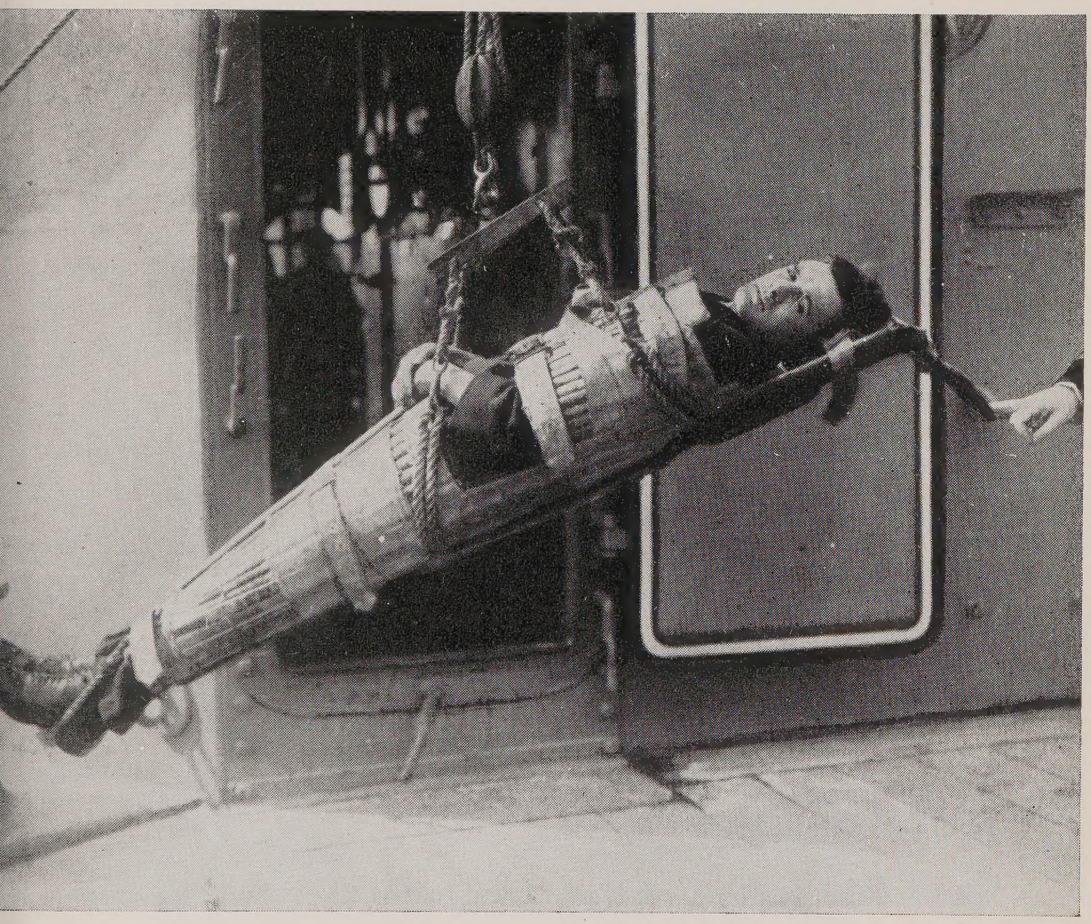


Fig. 209 (*b*).

The Neil Robertson Stretcher in Stoke Holds.

(First Aid in the Royal Navy.)

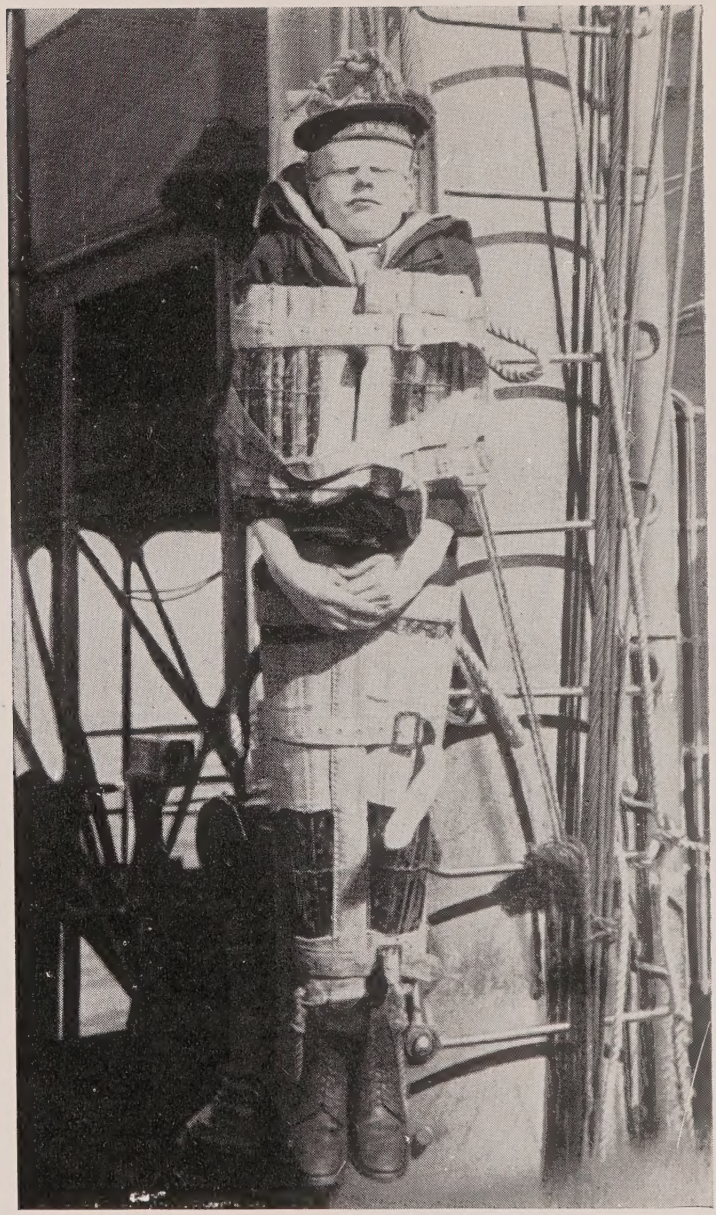


Fig. 209 (*c*).

The Neil Robertson Stretcher in Tops.

(First Aid in the Royal Navy.)

5. "Form fours"	The odd numbers stand fast, the even numbers take a pace to the rear with the left foot and a pace to the right with the right foot. *Each section of fours now forms a squad.*
6. "Squads number."	The front rank men of each squad number from the right.
7. "Bearers number."	The bearers of each squad number from the front to the rear.
8. "Bearers prove."	The bearers named will prove by a show of the right hand.
9. "Stretchers"	No. 1 and 4 of each squad will turn to their right and double smartly to the stretchers in the rear. No. 1 will take the foot and No. 4 the head of the closed stretcher in the right hand, and, with the rollers turned outwards, will double smartly back through the ranks, taking up their former positions. The stretchers will now be on the right of each squad.
10. "Return Stretchers."	Nos. 1 and 4 return the stretchers to the rear and resume their former positions.
11. "Stretchers"	As in No. 9.
12. "Open order for Stretcher Drill—Ready."	No. 1 Squad will stand fast, the other squads will turn to the left.
13. "March" -	No. 2 Squad will take 4 paces, No. 3 Squad 8 paces, No. 4 Squad 12 paces, and so on, halt, turn to their front, and dress in line with No. 1 squad.
14. "Ground Stretchers."	Nos. 1 and 4 place the stretchers on the ground on the right of their squads.

15. "Take up Stretchers."	
16. "Ground Stretchers."	As before.
17. "Open Stretchers."	Nos. 1 and 4 will place themselves at the foot and head of the stretchers respectively, sink on their right knees, grasp a pole in either hand, and open smartly, taking care that the transverse bars are firmly locked. They will then resume their former positions, taking their time from No. 1 Squad.
18. "Close Stretchers."	Nos. 1 and 4 take up the same position as for "Open Stretchers," sink on their right knees, grasp a pole in either hand and unlock the stretcher with the left foot. When the stretcher is properly closed they will resume their former positions, taking their time from No. 1 squad.
19. "Open Stretchers."	As before.
20. "Stand to Stretchers."	No. 1 will place himself at the foot of the stretcher; No. 2 will take a short pace to the rear, placing himself in the centre of the stretcher; No. 3 a full pace to the rear, placing himself at the head of the stretcher; No. 4 will place himself opposite No. 2.
21. "Squad" or "As you were."	The members of each squad will resume their former positions.
22. "Stand to Stretchers."	As before.
23. "Close Stretchers."	Nos. 1 and 3 close the stretcher as before.

24. "Take up Stretchers."	Nos. 1 and 3 take up the closed stretchers, rollers out, taking the time from No. 1 Squad.
25. "On the Wounded—March."	Each squad will march to within one pace to the rear of the patient's head, ground, open, and "stand to stretchers" (the stretchers being placed in line with the patient's body).
26. "For Loading—Prepare."	Nos. 1, 2, and 3 advance to the left side of the patient, and No. 4 to the right side, No. 1 placing himself opposite the knees, Nos. 2 and 4 opposite the hips, and No. 3 opposite the shoulders. The whole turn inwards together.
27. "Ready" -	The bearers kneel down on the left knee and take hold of the patient, No. 1 passing his hands and forearms beneath the patient's legs, hands wide apart. Nos. 2 and 4 pass their hands and forearms beneath the patient's hips and loins, and grasp each other's hands. No. 3 passes his left hand across the patient's chest and under the right shoulder, and his right hand beneath the left shoulder so as also to support the head.
28. "Lift" - -	The bearers raise the patient gently and rest him on the knees of Nos. 1, 2, and 3 bearers. As soon as he is securely rested, No. 4 disengages his hands with No. 2, doubles to the centre of the stretcher, grasps a pole in either hand (left hand across), lifts the stretcher, and places it directly beneath the patient, kneels on his left knee, taking up his former position, and assists in supporting the patient.

29. "Lower" -	The patient is lowered gently on to the centre of the stretcher, the bearers disengage and stand up.
30. "Stand to Stretchers."	As in Order No. 20.
31. "Lift" - -	The loaded stretcher is lifted by Nos. 1 and 3, evenly and together.
32. "March" -	No. 1 will step off with the right foot, Nos. 2, 3, and 4 with the left foot, so as to avoid unnecessary jolting of the patient.
33. "Halt" - -	The bearers halt.
34. "Ground Stretchers."	The bearers place the stretcher gently on the ground and then stand up.
35. "For Unloading — Prepare."	The bearers take up the same positions as for loading, No. 1 placing himself opposite the knees, Nos. 2 and 4 opposite the hips, and No. 3 opposite the shoulders.
36. "Ready" -	The bearers take up the same positions as for loading, kneel on the left knee, and take hold of the patient, as in Order No. 27.
37. "Lift" - -	The patient is lifted and supported as before on the knees of Nos. 1, 2, and 3. No. 4 disengages, grasps the stretcher as before described, and lifting it clear of the patient, places it on the ground one pace clear of the patient's feet. He then rejoins his squad and assists in supporting the patient.
38. "Lower" -	The patient is gently lowered, the bearers disengage, stand up, turn to their front, march straight forward to their position of "Stand to Stretchers," and halt.
39. "Squad" -	The bearers of each squad will resume their original positions on the left of the stretcher, as on the completion of Order No. 13.

40. "Close Stretchers."	As in Order No. 18.
41. "Squads Close."	No. 1 Squad will stand fast and the others close in on the left, Nos 1, and 4 of each squad carrying the stretcher which they will ground when in position.
42. "Take up Stretchers."	
43. "Return Stretchers."	As in Order No. 10.
44. "Reform Two Deep."	The odd numbers stand fast, the even numbers take a pace to the left with the left foot and a pace to the front with the right foot.
45. "Dismiss."	

After squads have been sent to collect the wounded (Order No. 25), each squad may act independently; in which case Orders 26 to 38 inclusive will be given by No. 4 Bearer of each squad.

II.—WITH THREE BEARERS.

1. "Number" -	Number the bearers 1, 2, 3. All orders will be given by No. 2, who will look after the injured part of the patient's body or limbs, to see that no bandages or splints become displaced, and also that No. 1 bearer, in lifting or carrying the stretcher, does not touch the patient's feet.
2. "Place the Stretcher."	No. 3 places the stretcher in line with the patient's body, the foot of the stretcher being close to his head.
3. "Fall in" -	No. 1 places himself on the left side of the patient in line with his knees, No. 2 on the left side just below the patient's shoulders, and No. 3 at the right side facing No. 2.

4. "Ready"	-	All kneel on the left knee. No. 1 places his hands, well apart, underneath the lower limbs, always taking care, in case of a fracture, to have one hand on each side of the seat of injury, Nos. 2 and 3 grasp each other's hands under the shoulders and thighs of the patient.
5. "Lift" -	-	The bearers rise together, keeping the patient in a horizontal position.
6. "March"	-	All take short side-paces, carrying the patient over the stretcher until his head is immediately over the pillow.
7. "Halt"	-	The bearers remain steady.
8. "Lower"	-	The bearers stoop down, gently place the patient on the stretcher, disengage their hands, and then stand up.
9. "Fall in"	-	No. 1 places himself at the foot of the stretcher with his back to the patient, No. 2 places himself at the left side of the patient, and No. 3 at the head, with his face towards the patient.
10. "Ready"	-	Nos. 1 and 3 place the slings (if used) over their shoulders, stoop down, and slip the loops of the slings on to the handles of the stretcher, which they then grasp.
11. "Lift Stretcher."		Nos. 1 and 3 bearers raise the stretcher steadily together and stand up.
12. "March"	-	Nos. 1 and 2 step off with the left foot, and No. 3 with the right.
13. "Halt"	-	The bearers remain steady.

14. "Lower Stretcher."	The bearers place the stretcher gently on the ground, remove the slings, and then stand up.
15. "Unload Stretcher —Ready."	The bearers prepare to take the patient off the stretcher, as at Orders 3 and 4.
16. "Lift" - -	The bearers raise the patient, as at Order 5, and carry him by short side steps, clear of the stretcher to the bed or other place to which it has been arranged to convey him.
17. "Lower" -	The patient is gently lowered.

III.—WITH THREE BEARERS WHEN THE STRETCHER CANNOT BE PLACED AS IN No. II.

1. "Number" -	Number the bearers 1, 2, 3. All orders will be given by No. 2.
2. "Place the Stretcher."	No. 1 taking the foot of the stretcher, and No. 3 the head, place it on the ground by the side of the patient and as close to him as practicable.
3. "Fall in." -	The three bearers take the same positions on one side of the patient, as laid down in Drill No. 1.
4. "Ready" -	All kneel on the left knee, placing themselves as close to the patient as they conveniently can, and then take hold of him as directed in Drill No. 1.
5. "Lift" - -	The bearers raise the patient as directed in Drill No. 1, and then move in a kneeling position up to the stretcher.
6. "Lower" -	The bearers bend forward, carefully lower the patient on to the stretcher, and disengage hands.

7. "Stand to Stretcher." — All the bearers stand up; No 1 goes to the foot, No. 2 remains in position at the side, and No. 3 goes to the head of the stretcher.

8. "Ready" -
9. "Lift Stretcher."
10. "March" -
11. "Halt" -
12. "Lower Stretcher."
13. "Unload Stretcher—Ready."
14. "Lift" - -
15. "Lower" -

The orders and detail from this point are the same as Orders 10 to 17 (inclusive) as described under Drill No. II. for Three Bearers.

Chapter XXVI.

SALUTING REGULATIONS.

1. The Naval Salute is to be made by bringing up the right hand to the cap, naturally and smartly, but not hurriedly, with the thumb and fingers straight and close together, elbow in line with the shoulder, hand and forearm in line, the thumb being in line with the outer edge of the right eyebrow, with the palm of the hand turned to the left, the opposite being the case when using the left hand.

2. When passing an Officer, the salute is to be made with the hand furthest from him, and commenced just before meeting, and continued until well past the Officer, the person saluting looking towards him at the same time.

3. The term "Officer" includes all Commissioned, Warrant, and Subordinate Officers.

The Head Sister and Sisters of a Naval Hospital are regarded as Officers, and must at all times receive the respect due to their position.

4. When coming over the gangway, or on to the quarter deck, the salute is to be made.

5. Petty Officers and men are to salute all Officers:—

(*a*) When addressing, or being addressed by an Officer, and again on withdrawing.

(*b*) When passing, or being passed by an Officer.

6. Petty Officers and men when not wearing caps, on being passed by Officers in Wards, Passages, Stairs, &c., are to stand to attention facing the Officer.

7. All Officers in uniform, both Naval and Military, and also those in plain clothes who are known to be Officers, are to be saluted.

It is to be understood that there is no excuse for not seeing an Officer, or for not recognising an Officer in plain clothes, who, either from his position, or by belonging to the same Ship as the man, ought to be known by him.

8. Should a Petty Officer or man be standing about, and an Officer pass him, he is to face the Officer and salute; if sitting when an Officer approaches, he is to rise, stand at attention and salute.

If two or more Petty Officers or men are sitting or standing about, the Senior Petty Officer or man will call the whole to attention, and alone will salute.

9. When men are marching, or fallen in, in charge of an Officer or Petty Officer, the Officer or Petty Officer is to salute, giving the usual command ("Attention," "Eyes Right," or "Eyes Left").

10. Officers and Men passing a funeral will salute the body.

11. When a Petty Officer or Man is brought before an Officer as a defaulter, or for the purposes of any investigation, he is to take off his cap.

12. Petty Officers and Men are to stand to attention during the playing of the National Anthem.

Chapter XXVII.

PREPARATION FOR A NAVAL ACTION.

Before an action, all medical and surgical stores are removed from the sick bay, which is unprotected by armour, to the distributing stations, which are behind armour.

In all ships, except the very smallest, there are two distributing stations, one forward and one aft.

The following will serve as a guide as to what is required in these stations:—

Foremost Station.	**After Station.**
Operating table.	Operating table.
Medicine chest No. 1.	Medicine chest No. 2.
Field chest.	Field chest.
Two emergency chests.	Two emergency chests.
X-ray apparatus.	Instrument chest.
Metal table.	Metal table.
Metal basin holder.	Metal basin holder.

In both stations the following must also be prepared:—

Large quantities of antiseptic lotions, sterilised dressings and swabs.
Hot and cold water.
Every available hypodermic syringe—especially Wildey's syringe.
Solutions of morphia for hypodermic injections.
Candles and matches.
Buckets for urinating.

For the use of each gun's crew the following should be supplied:—

Ambulance bags containing wool, lint, bandages, safety pins, scissors, and a Foulis' tourniquet.
First field dressings.
Picric acid dressings for burns and scalds.
Oatmeal water for drinking.
Boric lotion for bathing the eyes.
Wool for plugging the ears.
Buckets for urinating.

Before the action, every man should, if possible, have a bath and put on clean clothing—preferably white working rig. This helps to diminish the risk of septic infection of wounds.

He should also wear his silk handkerchief round his waist, to be used as a triangular bandage if necessary.

A metal "Identity Disc" is served out to every officer and man. It is to be worn round the neck on a piece of wire. This disc is stamped with the name, rank or rating, official number, and religion of the wearer, and is used for the identification of the killed and wounded.

PROCEDURE.

During an Action, only First Aid treatment will be attempted, and the wounded must be left where they fall, or moved only so far as to be out of the way of the gun's crews.

During a Lull in the Action, as many of the wounded as possible should be removed to the distributing stations by the stretcher parties, and there treated.

After the Action, the remainder of the wounded will be collected and treated. If no further action is likely to occur, the wounded will be removed from the distributing stations to some better ventilated space. Screened spaces on the upper deck or the Captain's fore cabin seem to be the most suitable. The wounded will be landed or transferred to Hospital Ships as soon as possible.

On first attending to the wounded a distinguishing mark is put on the clothes or cot of the wounded man to show the degree of wound sustained. A cloth luggage label with the undermentioned marks in indelible pencil should be used :—

Label without any mark = slightly wounded.
Label with *blue* pencil cross = severely wounded.
Label with *red* pencil cross = dangerously wounded.

These labels should be tied on in a conspicuous place so that on removal to Hospital the degree of wound may be evident without any examination or disturbance of the patient.

Chapter XXVIII.

LANDING PARTIES.

Personnel.

For every 200 men landed there will be—
2 Medical Officers,
6 Sick Berth Staff,
6 Stretcher Parties. Each stretcher party will consist of 12 men, as this is the minimum number capable of carrying a loaded stretcher any distance, allowing for frequent reliefs.

Equipment.

Each Medical Officer carries—
1 Surgical Pocket Case.
1 Hypodermic Case.
1 Water Bottle.
1 Notebook and Pencil.

Each member of the Sick Berth Staff carries—
1 Field Valise.
1 Water Bottle (large size).

Each Stretcher Party is provided with—
1 Surgical Bag.
1 Large Water Bottle with lock and key.
1 Lantern, Candle, and Matches, for searching for wounded at night.
1 Chopper for improvising splints.

Medical Equipment for Service in the Field.

(*a*) Field Chests Nos. 1 and 2. Weight of each 67 lbs.
(*b*) Field Valise. Weight 15½ lbs.
(*c*) Emergency Chest of Surgical Dressings. Weight, 70 lbs.
(*d*) Chests containing Medical Comforts.

EQUIPMENT FOR A BASE HOSPITAL.

Operating Table.
Steriliser for Instruments and Dressings.
Griffith's Water Steriliser.
Ice Chest.
X-ray Apparatus.
Portable Kitchen.
Bedding.
Cooking Utensils.

SANITARY ARRANGEMENTS IN THE FIELD.

When a camp is formed, a "Sanitary Section" will be drawn from members of the Sick Berth Staff, Domestics, Artisans, &c., whose duties will be:—

(1) The daily supervision of the water supply and its purification for drinking purposes by boiling, sterilisation, filtration, or by the addition of chemicals, as may be directed.
(2) To take charge of all apparatus and stores connected with the water supply of the landing party; such as sterilisers, tanks, &c.
(3) The supervision of the use of disinfectants in the camp or quarters as may be necessary.
(4) The preparation and care of latrines and urinals, including the filling in of the same and the marking of old sites.
(5) The systematic collection, removal, and disposal of refuse by burning or otherwise.
(6) The construction of washing places and the disposal of waste water.
(7) The sanitation of cooking places and slaughter houses.

Water Supply.

On landing, sentries are mounted on all water likely to be required for use, with orders to prevent pollution.

No water is to be used for drinking purposes, unless certified by the medical officer to be suitable.

The only certain method of purifying water is by boiling.

Water which has passed through a Berkefeld filter is usually safe to drink.

Muddy water, before being used, should be filtered or cleared before it is boiled. This may be done as follows :—

(*a*) With alum—6 grains to the gallon.

(*b*) By passing it through a sheet containing a couple of handfuls of wood ash.

(*c*) By placing two casks, one inside the other; these are pierced with holes, the outer one at the bottom, the inner one near the top; the space between is filled with sand, gravel, or wood charcoal. When the barrels are placed in water, the water rises into the inner cask.

Latrines.

These are fixed at least 100 yards from the camp, camp kitchen, and water supply.

Men are on no account to urinate elsewhere than in the urine pits or latrines; but at night, disused biscuit tins, &c., may be used, but must be kept outside the tents.

Latrines consist of short parallel trenches, 3 feet long, 2 feet deep, 1 foot wide, and not more than 1 foot apart. The user straddles, so that the urine and fæces fall into the trench without soiling the sides.

Each latrine is surrounded by some form of screen, and roofed.

After use, the excretions must be covered with soil to prevent flies carrying germs of disease to food or water.

Fresh trenches are dug every two days, the old ones completely filled in, and the site marked. This prevents old trenches being opened at a later date.

Disposal of Refuse.

All dry refuse should be burned.

Waste water is emptied into pits, the upper parts of which are filled with coarse brushwood to collect the grease, &c. The water thus cleared runs away in suitably dug trenches; the brushwood is burned every day, and replaced by a fresh lot.

Washing.

Places where the men can wash themselves and their clothes must be constructed at some distance from the drinking water supply.

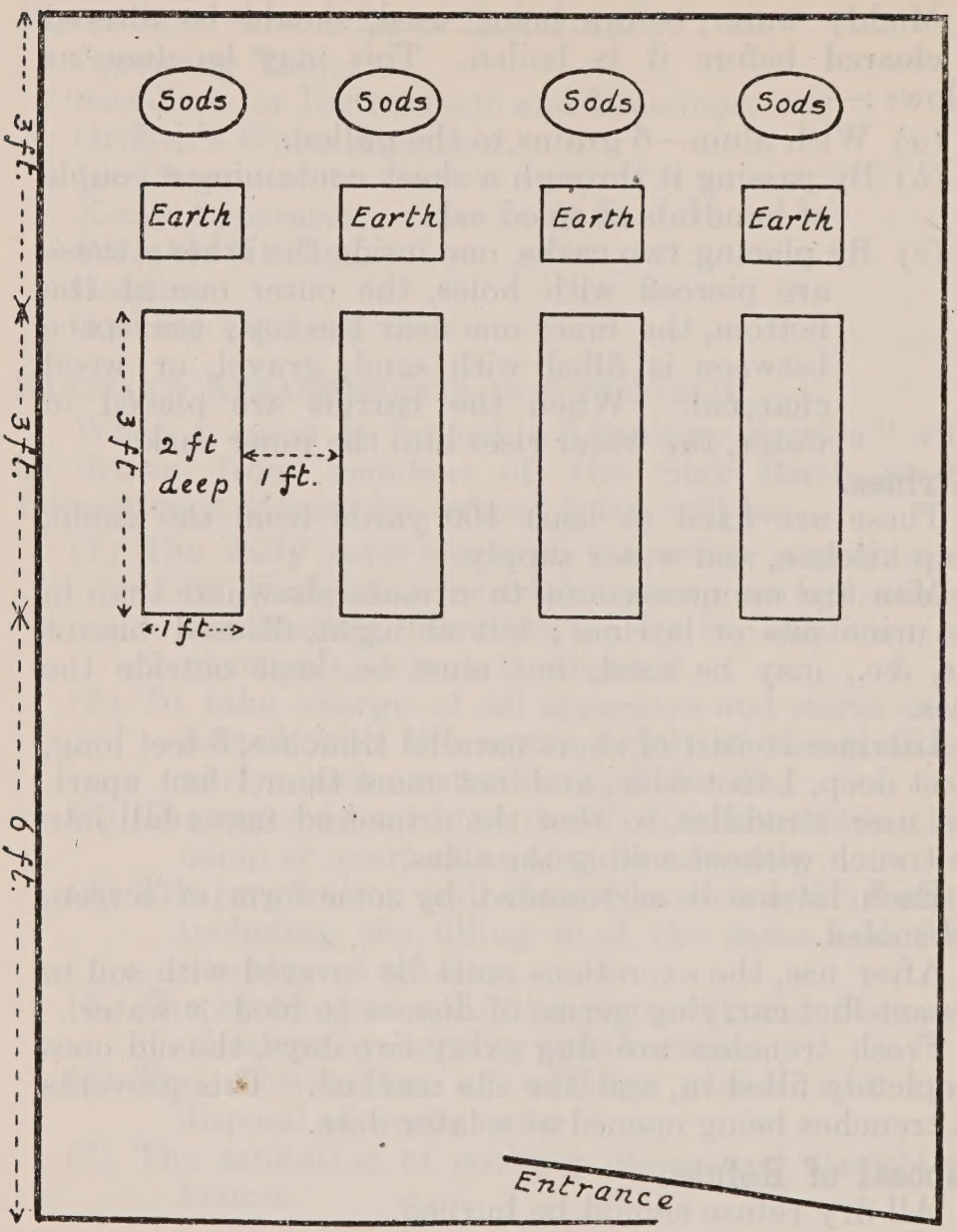


Fig. 210.
Plan of Camp Latrines.

Cooking.

Cooking for the ambulance and hospital party is done in the portable stove. This consists of two ovens, two boilers, four baking dishes, one grate, and two shelves. It weighs 90 lbs., and is capable of cooking for 50 patients.

Chapter XXIX.

CARE OF THE FEET.

While on the march, the feet must be looked after very carefully otherwise blisters and corns are certain to occur.

The following rules should be strictly observed :—

1. March in boots which are sound but not absolutely new. They should have stout soles, broad toes, and only moderately high heels. Nails are usually an advantage.
2. Keep the boots soft and pliable by using oil or dubbin, especially after getting wet.
3. Wear socks that fit properly. If too large, they wrinkle and cause blisters; if too small, they soon become holed and then also cause blisters.
4. Keep the socks in good repair, and change them as soon as they become holed.
5. Change the socks at the end of a day's march and hang up the worn pair to dry.
6. *Keep the socks and the feet clean*, the latter being washed with soap and cold water daily.
7. If the feet are very tender rub soap on them or on the socks before commencing the march. This often prevents the formation of blisters.
8. See that the gaiters are not too tight and that the trousers are neatly folded inside them. *Do not wear sock suspenders*, as the gaiter presses on the clip and after a time causes pain.
9. Keep the toe nails cut short.
10. Attend at once to any corns.

Chapter XXX.

FORMATION AND MANAGEMENT OF A SICK MESS.

When a ship is commissioned, the Medical Officer obtains a sum of money (usually £5) from the Accountant Officer with which to provide suitable food for the sick.

All men on the sick list are not necessarily victualled in the sick mess, as many of them are able to eat their ordinary food which they draw from their own mess.

The following medical comforts are carried in the ship and may be drawn on application to the Accountant Officer :—

Port wine, bovril, beef tea, gravy soup, ox tail soup (thick and clear), julienne soup, chicken broth, mutton broth, arrowroot, cornflour, sago and pearl barley.

Milk, chicken, and other fresh food are best obtained from the wardroom messman, with whom a monthly account is arranged.

All spirits and wines are obtained from the wardroom wine caterer, except port wine which, as stated, is included in the Paymaster's store of medical comforts.

The washing of the sick bay bedding is also paid for from the sick mess account.

Whenever a man joins the sick mess, the Accountant Officer must be informed so that he may check the man of his ordinary provisions.

No man in the sick mess is allowed to draw his spirit ration without the permission of the Medical Officer.

The sick berth Steward must record each day in the prescribed book, **S. 76b,** the names of all men on the sick list, and take it to the ship's office in time to enable the Accountant Officer to check the men of their spirit. The Medical Officer may, however, if he deem it necessary, allow the issue of the spirit ration, inserting

the permission, attested by his initials, in the spirit stoppage book, for the information of the Accountant Officer.

The Sick Mess Accounts are made up quarterly on **Form S. 16.**

Receipts must be obtained for all payments made from the Sick Mess Account and presented with the Statement.

Chapter XXXI.

INSTRUMENTS AND APPLIANCES IN THE SERVICE AFLOAT SCALE REQUIRED FOR VARIOUS OPERATIONS.

FOR PRACTICALLY EVERY OPERATION.

Scalpels.
Scissors.
Probes.
Directors.
Dissecting Forceps.
Retractors.
Aneurysm Needle.
Needles.
Needle Holder.
Sutures—horsehair.
Ligatures—catgut, silk.

For the following Operations, these *additional* Instruments and Appliances must be prepared :—

1. For Amputations.

Amputation Knives.
„ Saws.
Bone Forceps.
Lion „
Samway's or Foulis' Tourniquets.
Splints.

2. For Trephining.

Elevator.
Skull Forceps.
Lenticular.
Hey's Saws.
Tang Scalpel.
Trephines.
Quills.

3. For Operations on the Jaws.

Bone Forceps.
Lion „
Tooth „
Saws.

4. For Tracheotomy.

Sharp Hook.
Tracheotomy Tubes.
Tapes.
Sterilised Feathers.

5. For Empyema.

Bone Forceps.
Hypodermic (or Exploring) Syringe.
Drainage Tubing (large size).
Safety Pins.

6. For Appendicitis, and other Diseases of the Intestines.

Intestinal Needles.
Hernia Director.
Drainage Tubing.

7. For Hernia.

Hernia Bistoury.
„ Director.

8. For Stricture of the Urethra.

Wheelhouse's Staff.
„ Gorget.
„ Director.
Catheters, of every size and variety.
Drainage Tubing.
Tape.

9. For Hydrocele.

Trocar.
Canula.
Gauze and Collodion.

10. For Fistula in Ano.

Volkmann's Spoons.
Rectal Spectulum.
T. Bandage.
Morphia Suppositories.

11. For Hæmorrhoids.

Rectal Speculum.
T. Bandage.
Morphia Suppositories.

12. For Gunshot Wounds.

Bullet Forceps.
„ Probes.

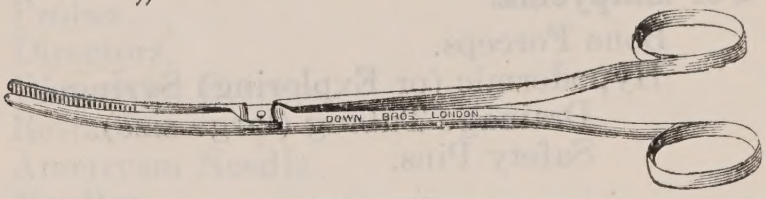


Fig 211.
Bullet Forceps.

Fig. 212.
Bullet Probe.

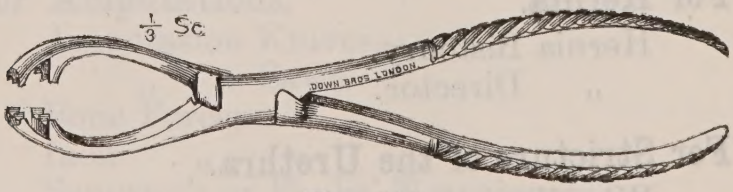


Fig. 213.
Lion Forceps.

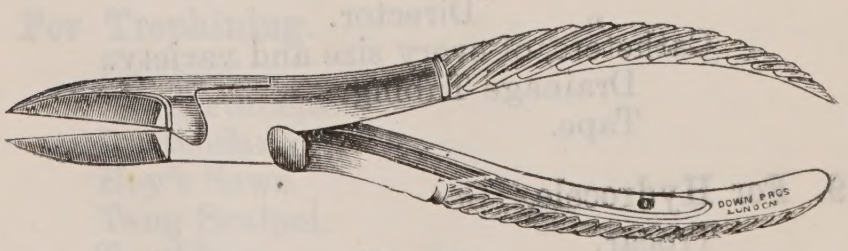


Fig. 214.
Bone Forceps (Straight).

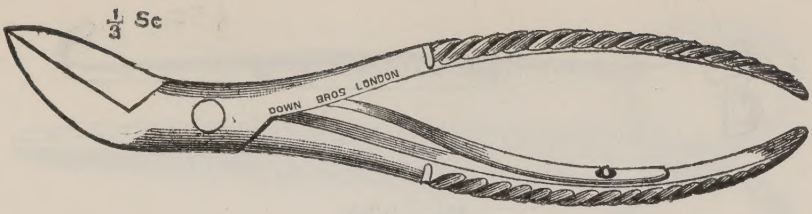


Fig. 215.
Bone Forceps, curved.

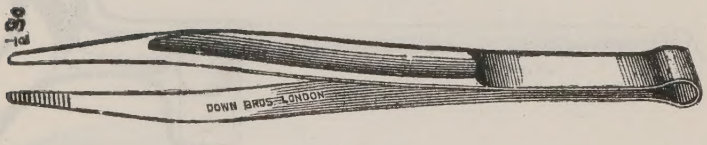


Fig. 216.
Spring Forceps.

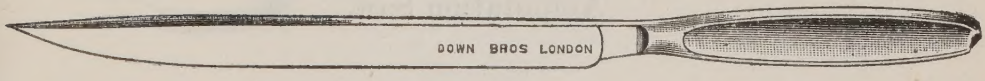


Fig. 217.
Amputation Knife.

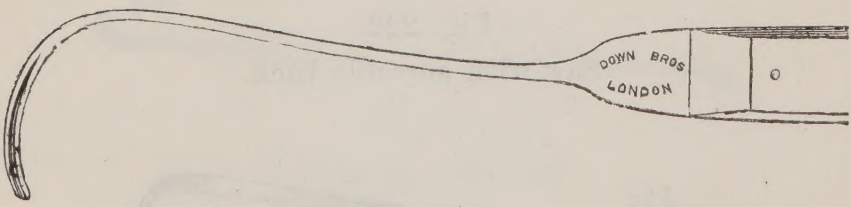


Fig. 218.
Aneurysm Needle.

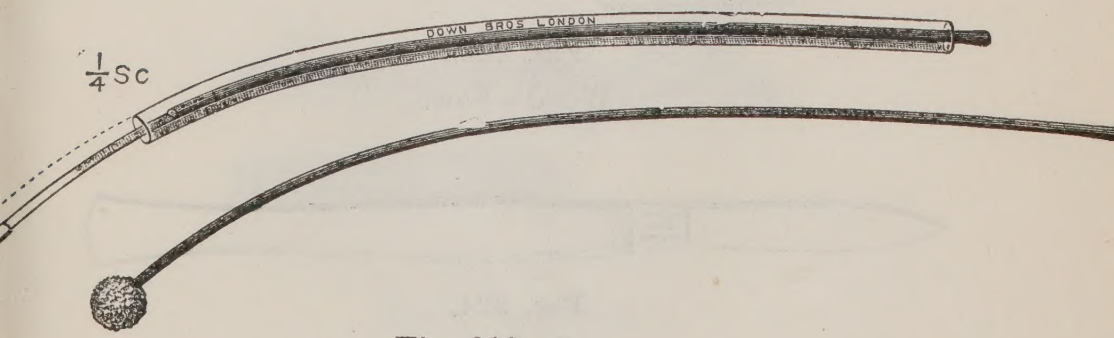


Fig. 219.
Coin Catcher and Probang.

Fig. 220.
Retractor.

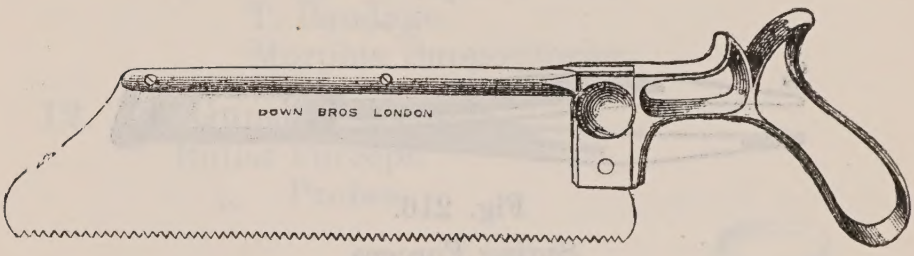


Fig. 221.
Amputation Saw.

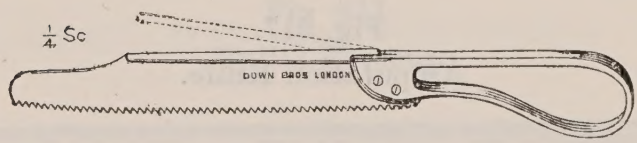


Fig. 222.
Saw with movable back.

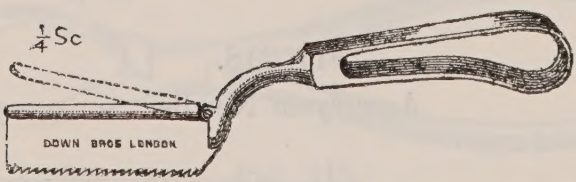


Fig. 223.
Wood's Saw.

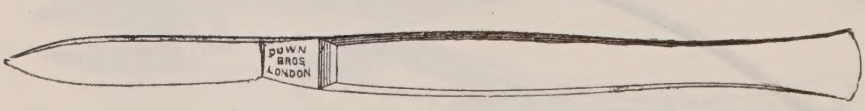


Fig. 224.
Scalpel.

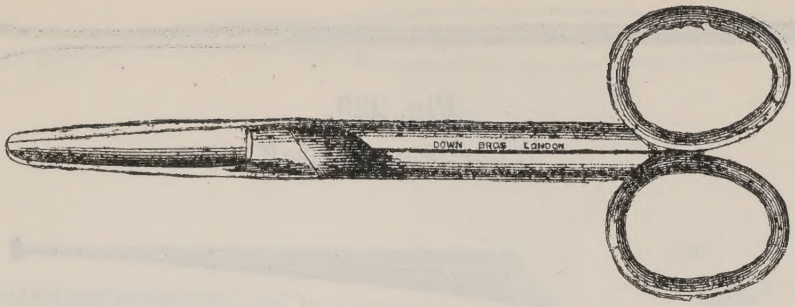


Fig. 225.
Scissors, straight.

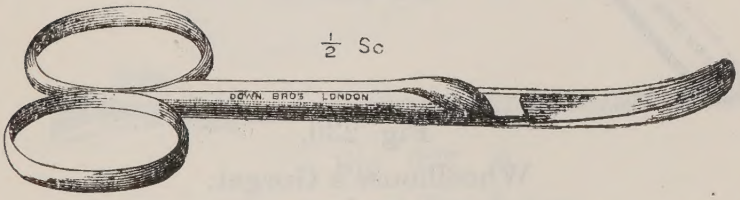


Fig. 226.
Scissors, curved on the flat.

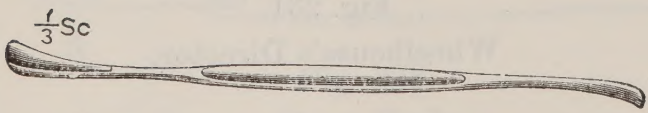


Fig. 227.
Volkmann's Spoons.

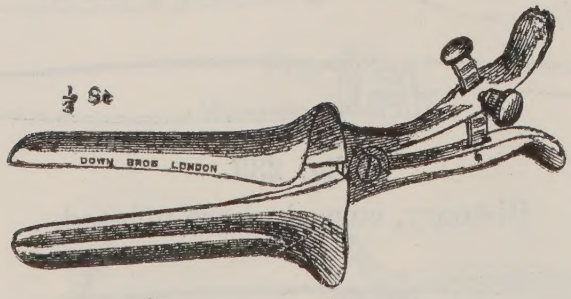


Fig. 228.
Rectal Speculum.

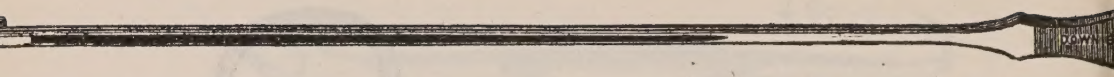


Fig. 229.
Wheelhouse's Staff.

Fig. 230.
Wheelhouse's Gorget.

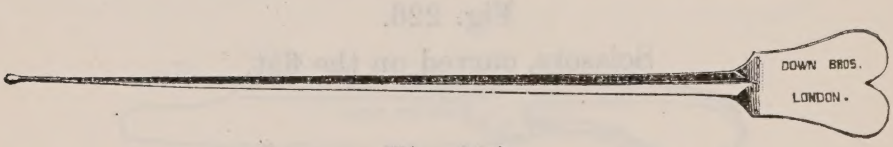


Fig. 231.
Wheelhouse's Director.

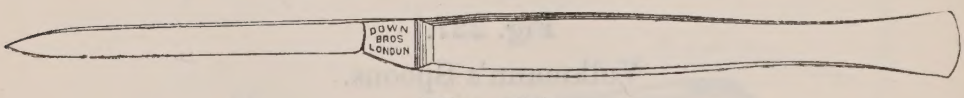


Fig. 232.
Bistoury, straight, sharp pointed.

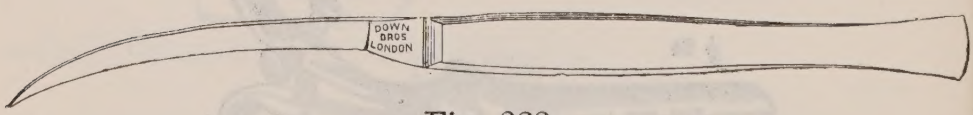


Fig. 233.
Bistoury, curved, sharp pointed.

Fig. 234.
Bistoury, curved, probe pointed.

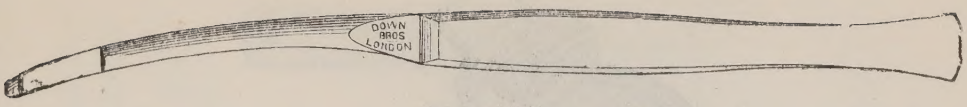


Fig. 235.
Hernia Bistoury.

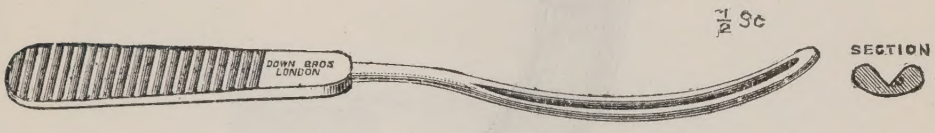


Fig. 236.
Hernia Director.

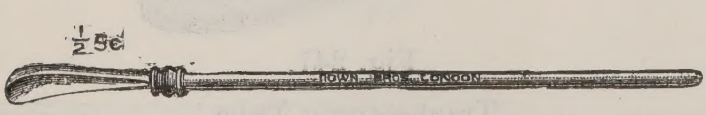


Fig. 237.
Director and Ear Scoop.

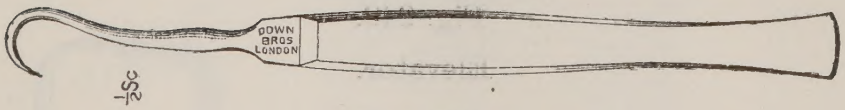


Fig. 238.
Sharp Hook.

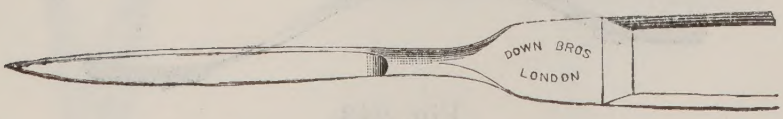


Fig. 239.
Tenotomy Knife.

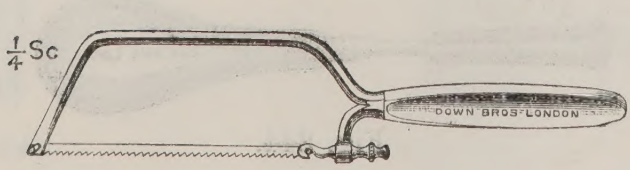


Fig. 240.
Metacarpal Saw.

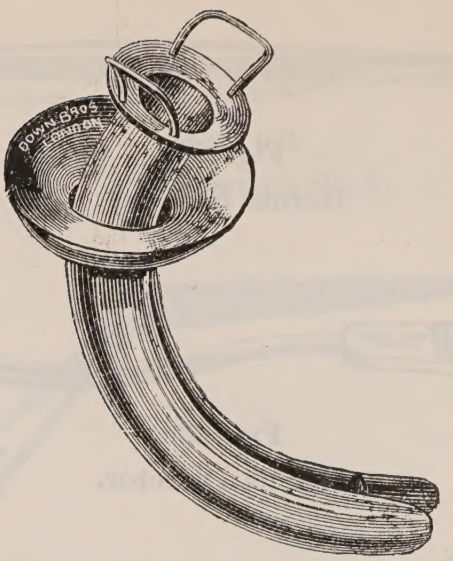


Fig. 241.

Tracheotomy Tube.

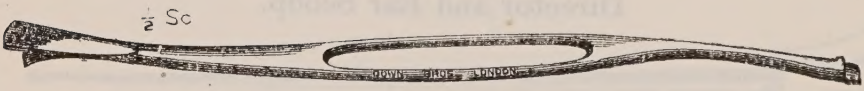


Fig. 242.

Elevator.

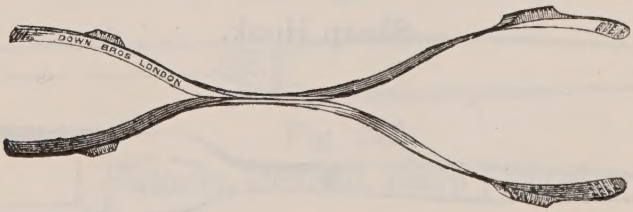


Fig. 243.

Skull Forceps.

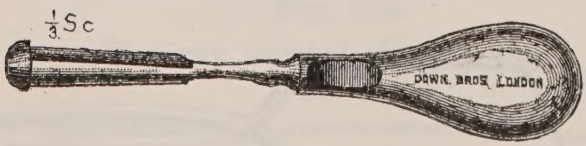


Fig. 244.

Lenticular.

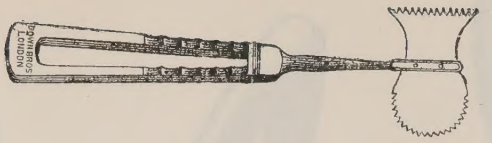


Fig. 245.
Hey's Saw.

Fig. 246.
Hey's Saw.

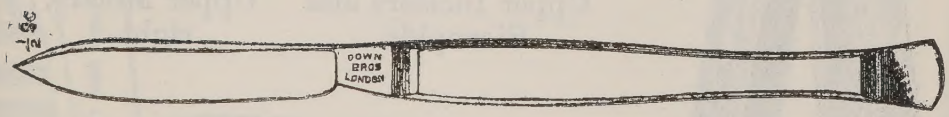


Fig. 247.
Tang Scalpel.

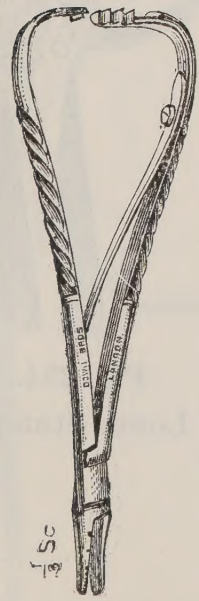


Fig. 248.
Needle Holder.

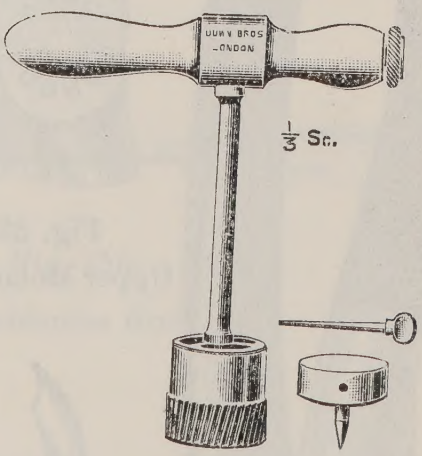


Fig. 249.
Trephine.

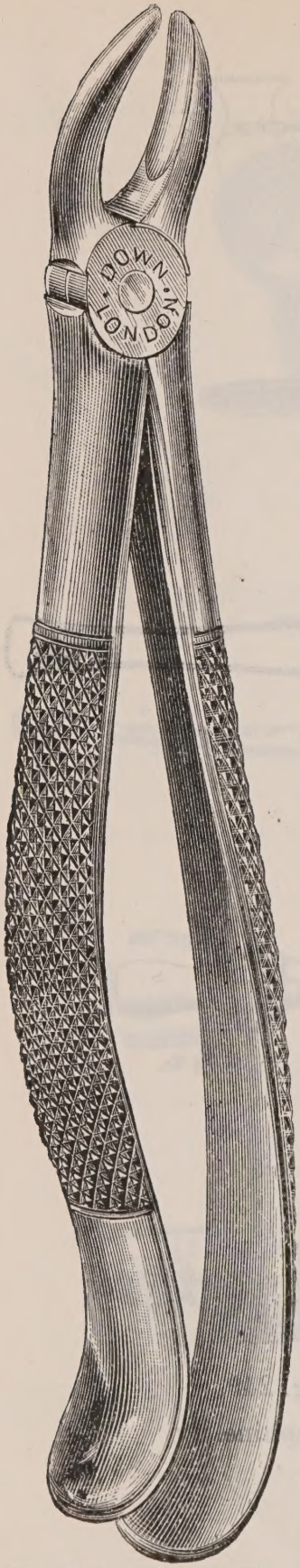


Fig. 251.—Upper Stumps.

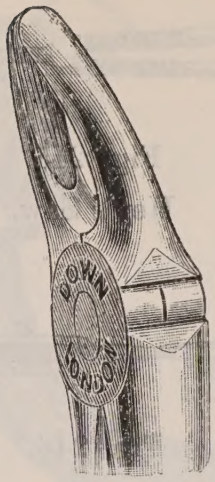


Fig. 250.
Upper Incisors and Bicuspids.

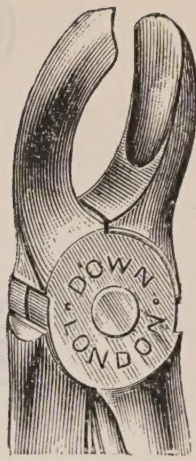


Fig. 252.
Upper Molars, right.

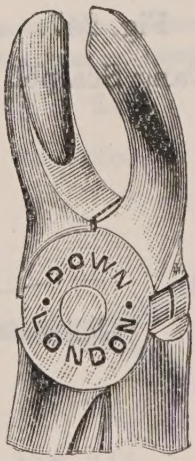


Fig. 253.
Upper Molars, left.

Fig. 254.
Lower Stumps.

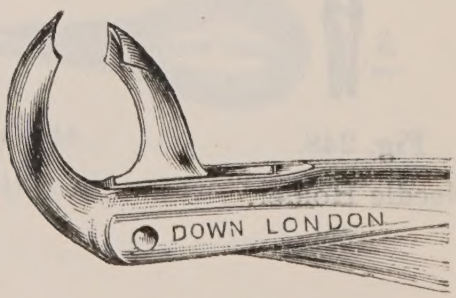


Fig. 255.
Lower Molars.

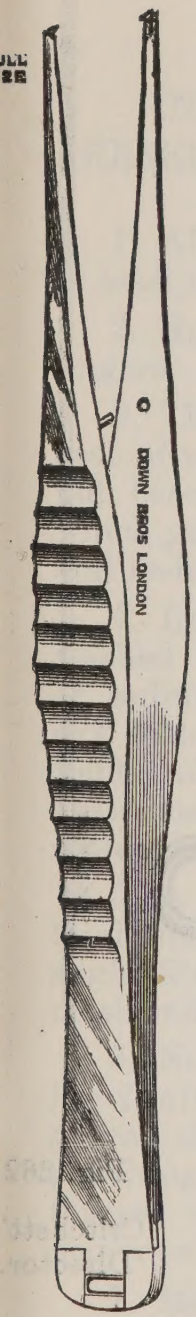


Fig. 259.
Fixation Forceps.

Fig. 256.
Cataract Knife, Graefe's.

Fig. 257.
Cataract Knife, Sichel's.

Fig. 258.
Strabismus Hook.

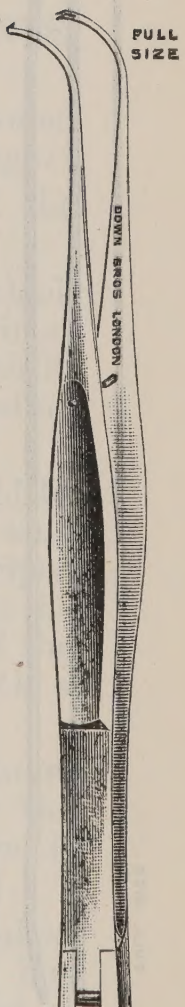


Fig. 260.
Iris Forceps.

Fig. 261.

Bowman's Probes.

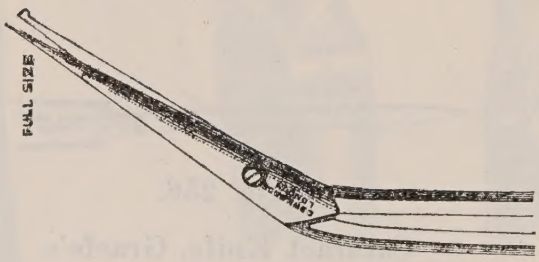


Fig. 263.

Elbow Scissors.

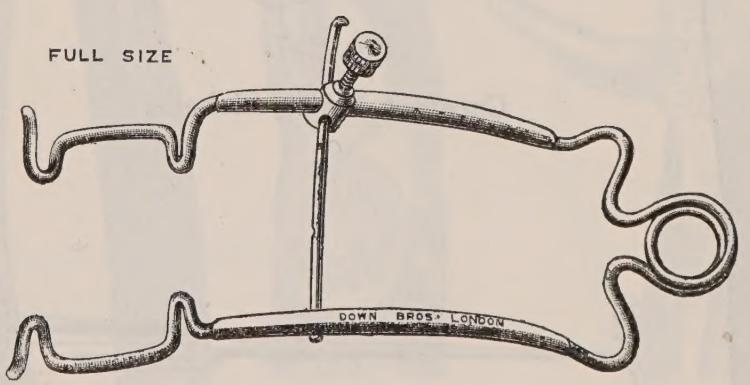


Fig. 264.

Bowman's Speculum,

Fig. 262.

Critchett's Director.

Chapter XXXII.

INSTRUCTIONS FOR THE CARE AND PRESERVATION OF SURGICAL INSTRUMENTS.

1. All Instruments are to be thoroughly overhauled at least once a month by the Medical Officer in charge.

2. Rusty spots frequently show the imprint of the fingers.

3. There is an erroneous idea that a sufficiently thick coat of vaseline will preserve an Instrument for all time; but brown stains are frequently formed underneath it, which go deep into the steel and necessitate re-grinding and re-burnishing.

4. Immediately after use, steel Instruments should be washed in warm water containing a little washing soda or sodium bi-carbonate, and as they are removed, wiped dry with a soft cloth, paying particular attention to the joints, and then polished with a chamois leather. If the Instruments are stained they may be polished with a little magnesia and methylated spirit.

5. A piece of lint, slightly moistened with paraffinum liquidum should be well rubbed over them, only the slight film of oil remaining. (A thick film of vaseline is most undesirable.)

6. No Instrument should be touched with the naked hand after being washed in the alkaline water, but gloves should be worn during the final operations of polishing and oiling. A rust mark will eventually be formed wherever they are touched if this precaution is neglected.

7. Metal Instruments should not be allowed to come into contact with mercuric perchloride solution.

8. When sterilising instruments by boiling, 1 per cent. of bi-carbonate of soda should be added to water;

this prevents Intruments being stained or becoming rusty; care should be taken that the Instruments are *fully* immersed. The boiling need not be more than five minutes.

9. White paper should not be allowed to remain in contact with the Instruments, as some of the chemicals used in bleaching are frequently retained in the paper. Thin brown tissue paper is generally free from these objectionable compounds.

10. The sulphur in vulcanised rubber readily attacks metal, and therefore indiarubber articles should never be kept in contact with metallic ones, but should be stored in a separate box; this applies to ether inhalers, mouth gags, &c.

11. Oily substances soften and destroy india-rubber articles and gum elastic catheters, &c. They should, therefore, be carefully cleaned after use, with soap and water, dried, and dusted with French chalk and stored where possible in air-tight tins.

Chapter XXXIII.

THE METRIC SYSTEM OF WEIGHTS AND MEASURES.

I.—MEASURE OF LENGTH.

1 Kilometre (Km.)	=	1,000 metres	= ·62 mile.
1 Hectometre (Hm.)	=	100 „	= 109·36 yards.
1 Dekametre (Dm.)	=	10 „	= 32·81 ft.
1 Metre (M.) -	-	-	= 39·37 ins.
1 Decimetre (dm.)	=	·1 metre	= 3·93 ins.
1 Centimetre (cm.)	=	·01 „	= ·39 in.
1 Millimetre (mm.)	=	·001 „	= ·039 „
1 Micron (m)	=	·000001 „	= ·000039 in.

II.—MEASURE OF WEIGHT.

1 Kilogram (Kgm.)	=	1,000 grammes	= 2·2 lbs.
1 Hectogram (Hgm.)	=	100 „	= 3·52 oz.
1 Dekagram (Dgm.)	=	10 „	= 154·33 grains.
1 Gramme (Gm.) -	-	-	= 15·43 grains.
1 Decigram (dgm.)	=	·1 gramme	= 1·54 grains.
1 Centigram (cgm.)	=	·01 „	= ·15 grain.
1 Milligram (mgm.)	=	·001 „	= ·015 grain.

III.—MEASURE OF CAPACITY.

1 Kilolitre (Kl.)	=	1,000 litres	= 219·976 gallons.
1 Hectolitre (Hl.)	=	100 „	= 21·997 gallons.
1 Dekalitre (Dl.)	=	10 „	= 2·199 gallons.
1 Litre (L.) - - - -			= 35·196 oz.
1 Decilitre (dl.)	=	·1 litre	= 3·519 „
1 Centilitre (cl.)	=	·01 „	= ·352 „
1 Millilitre (ml.)	=	·001 „	= ·035 „

EQUIVALENTS OF IMPERIAL AND METRIC MEASURES.

1 inch = 2·5 centimetres.

1 centimetre = ·39 of an inch.

1 pound avoirdupois = 453·592 grammes.

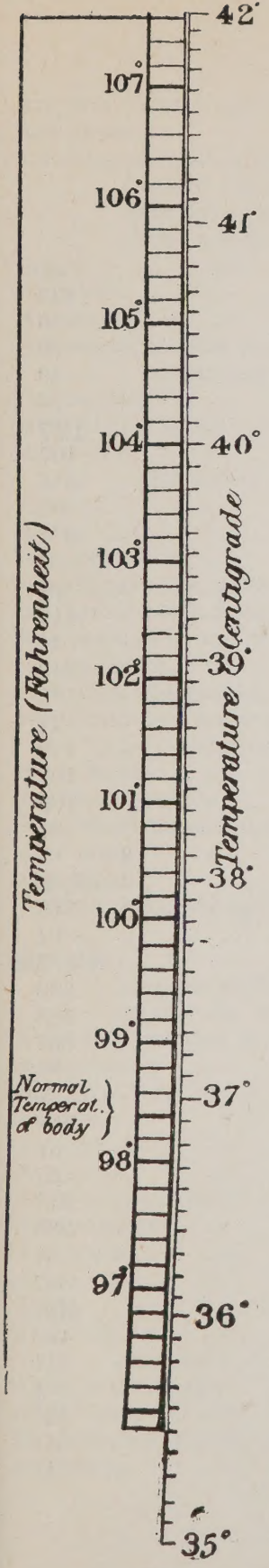
1 ounce avoirdupois = 28·35 grammes.

1 gramme = 15·4323 grains.

1 kilogram = 2 lbs. $3\frac{1}{4}$ oz. avoirdupois.

1 fluid ounce = 28·42 cubic centimetres.

1 cubic centimetre = 1 millilitre = 16·9 minims.



COMPARISON OF THE FAHRENHEIT AND CENTIGRADE THERMOMETRIC SCALES.

104° F. = 40° C. exactly.

Fahrenheit.		*Centigrade.*
212°	Boiling Point	100°
32°	Freezing Point	0°
98°·4	Normal Temperature of Body.	36°·9

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